July 1940

TECHNOLOGY REVIEW

Title Reg. in U. S. Pat. Office

NORTON ABRASIVES

Industry Is "Precision Conscious"

The Norton precision machines for grinding, lapping, honing and superfinishing, in combination with Norton Abrasives, are producing the high degree of precision and finishes now called for in industry.

WHEN IT'S A GRINDING PROBLEM, CALL IN NORTON ENGINEERING SERVICE

NORTON COMPANY
WORCESTER, MASS.

BEHR-MANNING DIVISION, TROY, N. Y. (ABRASIVE PAPER AND CLOTH)

THE TECHNOLOGY REVIEW, July, 1940. Vol. XLII, No. 9. Published monthly from November to July inclusive at 10 Ferry Street, Concord, N. H. Publication date: twenty-seventh of the month preceding date of issue. Annual subscription $3.50; Canadian and Foreign subscription $4.00. Entered as second-class matter at the Post Office at Concord, N. H., under the Act of March 3, 1879

THE TABULAR VIEW

TECHNOLOGY'S seventy-third Commencement Day and the Alumni Association's fifth annual Alumni Day combine to bring to this issue of The Review a group of papers of more than usual interest, representing a group of authors distinguished in their respective fields of activity. ¶ JAMES BRYANT CONANT, whose baccalaureate address commences on page 367, noted as a chemist for his studies of photosynthesis, has, as president of Harvard University since 1933, evidenced in university administration the vision and vigor responsible for his scientific repute. His discussion of the relationship of governmental forms and philosophies to the activities which scientists and technologists recognize as vital is of particular import now. ¶ The same concern with purposes and consequences of government, though from a different point of view, marks the commencement address (page 370) of HENNING W. PRENTIS, JR., President of Armstrong Cork Company and President of the National Association of Manufacturers. In the article drawn from his address, additions necessitated by present circumstances for the traditional three R's of education are related to interesting analogies in the world of science. ¶ World affairs and their possible untoward significance, touched upon repeatedly in these two addresses, were the core of the Alumni Day Conference on communications — on the art which brings news swiftly by varied means to readers and listeners everywhere, and which itself encounters new demands and undergoes new transformations as the pressure of events increases. In FRANK B. JEWETT, '03, President of the Bell Telephone Laboratories, Inc., and retiring President of the Alumni Association; JAMES H. FURAY, Vice-President of the United Press Associations; and ALFRED H. MORTON, Vice-President in Charge of Television of the National Broadcasting Company, Inc., the conference was fortunate in having speakers eminently qualified to analyze the responsibilities of radio and press in times of international stress, to discuss the effect to be expected upon people in general from a ready supply of news even during the process of the events producing it, and to suggest attitudes proper for the disseminating agency and for the people whom it serves. Articles drawn from their remarks at the conference begin on page 372, and are followed (page 378) by the tenth M.I.T. library reading list, compiled this year by MRS. RUTH MCG. LANE, Vail Librarian, and presenting an analytical conspectus of sources dealing with communication by electric waves. ¶ PRESIDENT COMPTON'S annual survey of Institute affairs, a feature of the Alumni Day banquet, is of especial interest in this decennial year of his administration, which was signalized at the banquet. It appears in large part in this issue (page 383), as do excerpts from his stimulating address to graduates (page 384). ¶ Dedication of the Alumni Swimming Pool, this year's manifestation of alumni loyalty to the Institute and interest in undergraduates, is reported this month (page 380).

No. 27

Just for Fun!

A CHALLENGE

TO YOUR INGENUITY

SEE if you can arrange 11 dots so that they form 16 straight rows of 3 dots each. Also prove that 17 rows cannot be formed. Solutions must lie in one plane and must not be based on "tricks." [The first part of this problem appeared in a newspaper puzzle section several years ago — and "stumped" most readers.]

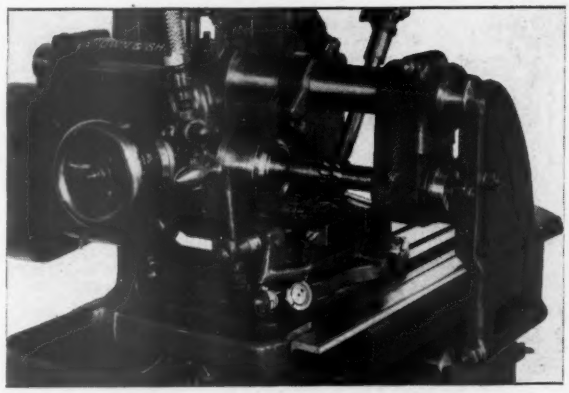
The 11 Dot Problem

Points placed in the specified arrangement seem to acquire "16-lineness." We noticed that many entirely different solutions could be found by starting with groups of 5 points selected from our first solution. Why is this? Apparently, a large number of solutions can be passed through *any* 4 points. How many?

We specialize in industrial physics and offer a "GUARANTEED RESEARCH SERVICE"

CALIBRON PRODUCTS, INC.

West Orange, New Jersey



Investigate No 000

— for *Lower* Milling Costs on Small Second Operation Work

B·S

Write for details

Brown & Sharpe Mfg. Co., Providence, R. I.

• • • **Metal removing ability, combined with fast operation, gives the No. 000 Plain Milling Machine a distinct advantage on second operation work in lowering costs.**

BROWN & SHARPE

Samson Trade-Mark

Samson Cordage Works

Boston, Mass.

Herbert G. Pratt, '85, *Chairman of the Board*

Manufacturers of braided cords of all kinds, including sash cord, clothes line, trolley cord, signal cord, shade cord, Venetian blind cord and tape, awning line, etc., etc.

SAMSON SPOT CORD

Reg. U. S. Pat. Off.

Our extra quality sash cord, distinguished at a glance by our trade-mark, the colored spots. Especially well known as the most durable material for hanging windows, for which use it has been specified by architects for more than forty-five years.

MAIL RETURNS

Ciphers

FROM CHARLES L. SHEDD, '02:

I was very much interested in the article in the June Review by Mr. A. H. Phillips, entitled, "Cipher for Secrets." As a boy in school I began to take an interest in the subject and, with a chum, invented a cipher which had several hundred characters in its alphabet and which we could write and read practically as readily as we could English. We protected ourselves from any demand from a teacher to translate our notes by a solemn promise to each other not to give any one our secret, and of course no honorable teacher would insist on our breaking such a promise. This cipher is still used by me for making notes and has been especially helpful in writing down impressions made by any one who came to me to have an interview.

Years afterwards I worked for one summer on ciphers for Mr. C. P. Bowditch, using a treatise on ciphers written by a certain Gustavus Selenus, who was supposed to have really been Francis Bacon, who was an English expert on ciphers. This work was in connection with the Shakespeare-Baconian controversy but led to no results of any value. However, in the World War the newspapers publicised a cipher used by the Germans, in which the picture of a beehive figured, with bees flying about in the air. This was in principle the same as a cipher pictured by Gustavus Selenus.

Using Vigenère as a basis, I invented a cipher which to my mind is much more difficult to solve. Here are some examples, the solutions for which will be found in this letter *if found at all:*

Ewg Zyfuquqres xa je.
Fzcijc Recenp Zwe.
Kiezepwavyazg.
Vnvij vy iy eriguhaiwegunvsus Qfze.

I think that any one who tries to solve these quotations written in cipher will first be interested in the fact that my statement that the solutions are in this letter will give very little, if any, help.

Arlington, Mass.

MARKING TUBES

FOR LABORATORY & INDUSTRIAL USE

- DYE RESIST
- CAUSTIC PROOF
- BLEACH PROOF

COLORS

Nissen

JOHN P. NISSEN JR., CO.
WYNCOTE, PENNA.

BLUE PRINTS

WE HAVE WHAT IT TAKES!

ELECTRO SUN CO.

UPTOWN OFFICE • MURRAY HILL 6-6526-7-8
Grand Central Terminal Building • 70 East 45th Street, New York City

DOWNTOWN OFFICE • BARCLAY 7-2334-5-6
161 Washington Street • Near Cortlandt Street, New York City

A. L. Weil '01

MEETING A SERVICE CHALLENGE

Coal mine shaker conveyors work in cramped quarters. If a conveyor fails, everything stops until repairs or replacements are made. So conveyors must be capable of continuous operation.

One manufacturer now meets the challenge by using Chromium-Molybdenum (SAE 4140) Steel for the all-important crank shafts of his shaker conveyors.

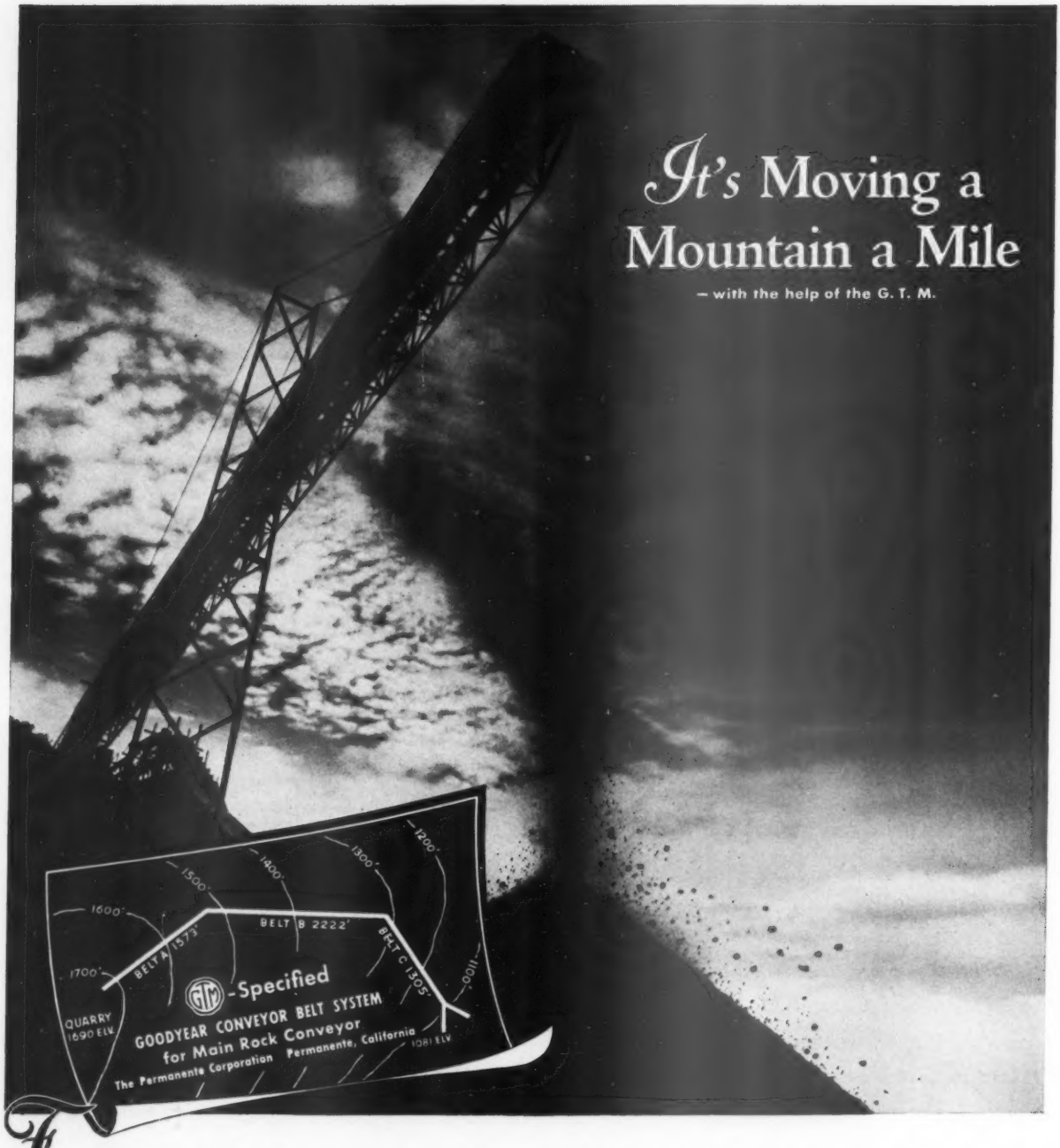
When properly heat treated, the steel develops good tensile and fatigue strength in the 5¾" section used, together with adequate hardness. Conveyor crank shafts made of this steel are achieving remarkable service records.

If anywhere in a product there is a part which presents special difficulties it often pays to investigate the possibilities of Molybdenum steels. Complete data will be found in our technical book, "Molybdenum in Steel," which is sent free to interested technical students on request.

PRODUCERS OF MOLYBDENUM BRIQUETTES, FERRO-MOLYBDENUM, AND CALCIUM MOLYBDATE

Climax Molybdenum Company
500 Fifth Avenue New York City

MOLY



From high up a rugged California mountain comes the stream of limestone rock you see here cascading from the end of a Goodyear conveyor belt—one of the most remarkable belt hauls in the world. Built to transport millions of tons of rock to be used in manufacturing cement for the gigantic Shasta Flood Control Dam, the conveyor winds up and down the sides of the mountain, swooping up-hill and down-dale like a great roller coaster. Under impetus of a 700-ton-per-hour down-hill load the belts drive generators that supply much of the electricity used for excavating and primary crushing of the rock. Completely equipped with belts specified by the G.T.M. — Goodyear Technical Man— this system proves the economy of conveyor haulage over terrain where other transport methods cost prohibitively. If you have bulk tonnage to transport, either a few feet or a score of miles, it will pay you to consult the G.T.M. Write Goodyear, Akron, Ohio, or Los Angeles, California—or phone the nearest Goodyear Mechanical Rubber Goods Distributor.

THE GREATEST NAME IN RUBBER

GOODYEAR

Marine retrospect

Jane Cook

THE TECHNOLOGY REVIEW

Title Reg. U. S. Pat. Office

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

VOL. 42, NO. 9 CONTENTS JULY, 1940

THE COVER

MORENCI PIT

From a photograph by John Skara

FIXED FOR ADMIRATION . . . . . FRONTISPIECE 362

THE ENDURING FREE SOCIETY . . . . . BY JAMES B. CONANT 367
Will to Live Essential in Withstanding Totalitarian Challenge

TECHNICAL MEN IN A REPUBLIC . . . . . BY HENNING W. PRENTIS, JR. 370
Special Duties Required from Those Scientifically Trained

NEWS AND THE STATE . . . . . BY FRANK B. JEWETT 372
Swifter Communication of Information Leads to Important Consequences

WORLD NEWS GATHERING . . . . . BY JAMES H. FURAY 374
From Phantasm of Today to Actuality of Tomorrow

RADIO IN WORLD AFFAIRS . . . . . BY ALFRED H. MORTON 376
Great Values and Problems Generated as a Result of Broadcasting

NEWS BY ELECTRIC WAVES . . . . . BY RUTH MCG. LANE 378
A List of Titles Significant in Communications

ALUMNI DAY 1940 379
A Camera Record

SECOND TO NONE 380
Alumni Swimming Pool Is Dedicated

A DAY AND A DECADE 382
Alumni Day 1940 Celebrated as Marking Dr. Compton's Tenth Year

THE TABULAR VIEW 357

MAIL RETURNS 358

THE TREND OF AFFAIRS 363

THE INSTITUTE GAZETTE 384

Editor
FREDERICK G. FASSETT, JR.

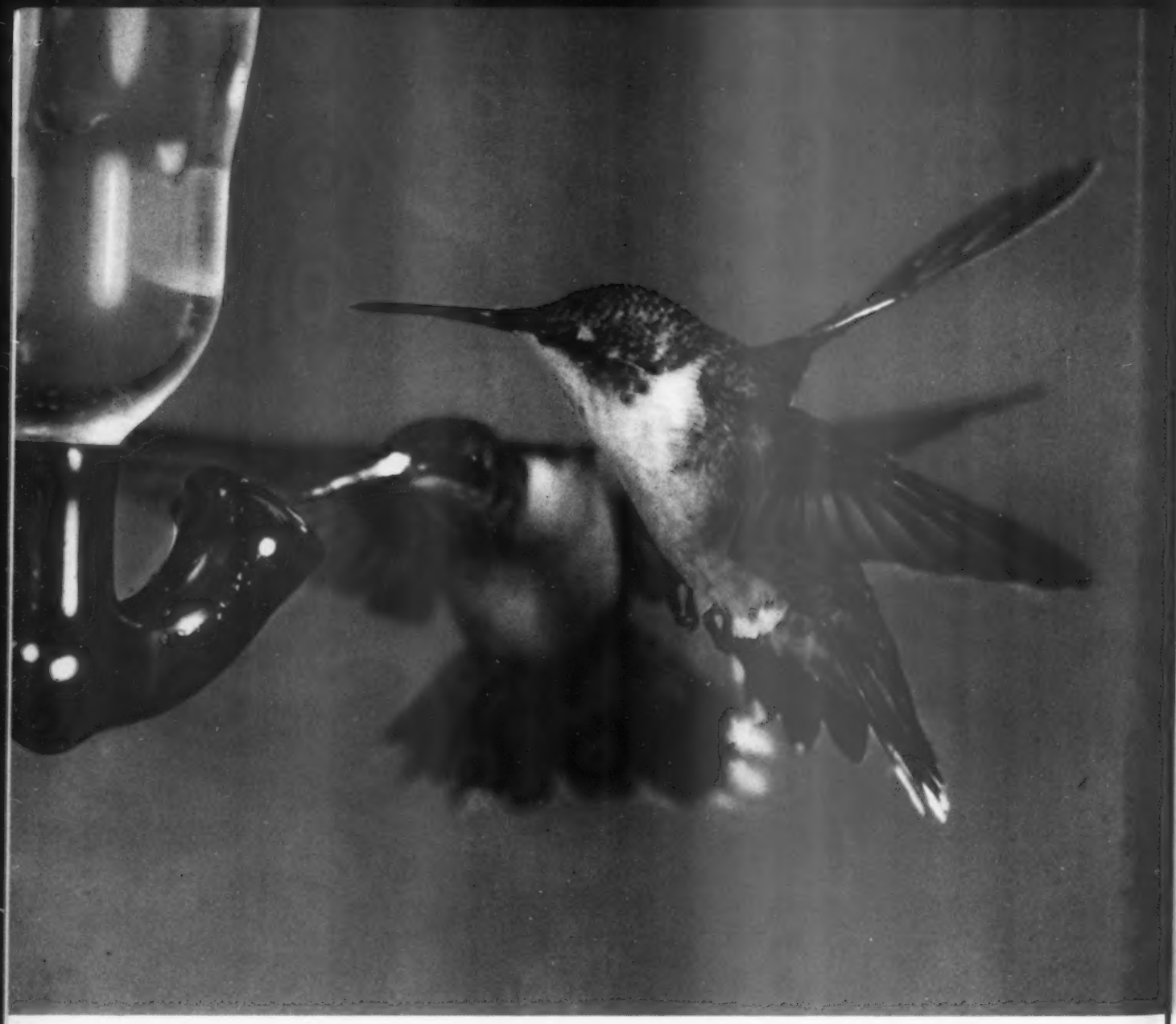
Publisher
H. E. LOBDELL

Business Manager
RALPH T. JOPE

Editorial Associates
J. E. BURCHARD · PAUL COHEN · T. L. DAVIS · J. R. KILLIAN, Jr. · P. M. MORSE · J. J. ROWLANDS

Staff
Editorial: JANE MCMASTERS, RUTH WESTWOOD. *Business:* MADELINE MCCORMICK, RUTH KING

PUBLISHED MONTHLY FROM NOVEMBER TO JULY INCLUSIVE ON THE TWENTY-SEVENTH OF THE MONTH PRECEDING THE DATE OF ISSUE AT 50 CENTS A COPY. ANNUAL SUBSCRIPTION $3.50; CANADIAN AND FOREIGN SUBSCRIPTION $4.00. PUBLISHED FOR THE ALUMNI ASSOCIATION OF THE M.I.T. HENRY E. WORCESTER, PRESIDENT; A. WARREN NORTON, JOHN E. BURCHARD, VICE-PRESIDENTS; CHARLES E. LOCKE, SECRETARY; RALPH T. JOPE, TREASURER. PUBLISHED AT THE RUMFORD PRESS, 10 FERRY STREET, CONCORD, N. H. EDITORIAL OFFICE, ROOM 3-219, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE A, MASS. ENTERED AS SECOND-CLASS MAIL MATTER AT THE POST OFFICE AT CONCORD, N. H. COPYRIGHT, 1940, BY THE ALUMNI ASSOCIATION OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY. THREE WEEKS MUST BE ALLOWED TO EFFECT CHANGES OF ADDRESS. BOTH OLD AND NEW ADDRESSES SHOULD BE GIVEN.



WINGS so swift that the eye cannot perceive their motion, and iridescent color of jewel-like values that cannot be fully sensed when the bird is hovering have here been fixed for admiration through the stroboscopic photography of Harold E. Edgerton, '27, and the four-color lithography of The Forbes Lithograph Company of Boston, of which William S. Forbes, '93, is president. The exposure: 1/30,000 second on Kodachrome.

THE
TECHNOLOGY
REVIEW

Vol. 42, No. 9 July, 1940

The Trend of Affairs

Doctor Diet

THE announcement that an African copper-mining company's experiments in feeding its native workers have improved not only the laborers' health but also the company's balance sheet, throws a sharp side light on the general economic value of adequate nutrition. Doctors have for a long time maintained that a sound diet is fundamental to a vigorous and healthy existence. Because of the difficulties that ordinarily face a private or, for that matter, a public, institution when it attempts to interfere with people's food habits, however, the improvement of worker efficiency by improved diet is not yet important personnel work.

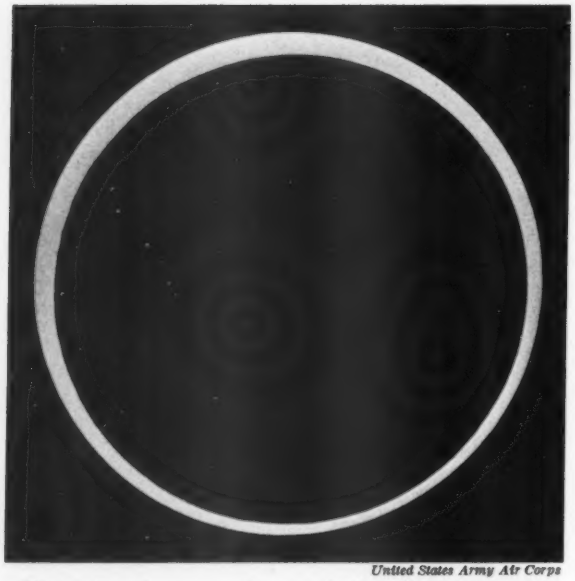
Yet only 10 per cent of the time lost by American employees is lost by reason of accidents or diseases acquired within the plant. The copper-mining company, for instance, after three years of observations that are still in progress, found that its native laborers almost doubled their working capacity and resistance to disease when fed a balanced diet, which differed from the natives' usual food most sharply in the amount of animal protein it contained. Ordinarily the natives subsist on starchy foods like maize, millet, and cassava.

It is stated that a native worker ordinarily has but half the capacity for work and a third the resistance to disease of a white man in the same environment, but, naturally, many factors other than diet are involved here. Still, the chairman of a Royal Commission which investigated this and other aspects of life in South Central Africa has stated flatly that "the scientific feeding of a qualitatively starved native with a balanced ration and of his wholly starved land with humus, coupled with the suppression of the tsetse fly and the concomitant greater availability of bovine meat would solve — directly or indirectly — nine-tenths of the crying problems of South Central Africa."

In our own country, effects of grossly inadequate diets do not intrude so emphatically on industrial consciousness, and attention tends to focus on specific deficiencies brought out by unusual working conditions, such as high temperature and its accompanying cases of heatstroke. This problem was solved when a steel company found that workers who drank beer were far more resistant to heatstroke than those who abstained completely or those who went in for stronger beverages. Further inquiry disclosed that it was not the beer but the salt the men shook into it and absorbed with their pretzels that did the trick. Workers who lose large amounts of perspiration, which is slightly saline, need extra salt in order to keep the concentration of that substance in the blood at the proper level for health and efficiency.

Diet has also solved inspection and matching difficulties encountered in the manufacture of colored articles, such as porcelain-coated sheets. In differentiating among colors, the eyes draw on their supply of visual purple, which is replenished only with the aid of vitamin A. Drastic drops in rejections have followed the feeding of foods or concentrates rich in this vitamin to inspectors suffering from eye fatigue.

More directly concerned with the problems of fatigue are the studies on how various foods and eating habits affect muscular efficiency. A diet rich in carbohydrates, for example, permits higher muscular efficiency than one rich in fats. It also appears that a man can create muscular energy more efficiently after a meal than when hungry. In an experiment on factory workers doing light, repetitive work, it was found that workers eating five meals a day could produce 10 per cent more than workers eating the traditional three. The argument is also presented that five is no more or less an arbitrary number than three, and that it is large rather than frequent meals that hinder digestion.



United States Army Air Corps

The sun in eclipse as seen from an airplane at 35,600 feet over Jacksonville, Fla., at 5:07 P.M. on May 7. The temperature at that altitude was 33 degrees below zero. As far as is known, this is the highest picture of an eclipse yet taken.

Except that they might be confused by verbiage high in vitamins, carbohydrates, and calories, our ancestors would not be surprised at the results of better feeding: They always said that diet cures more than doctors.

New Needs, "New" Metals

TECHNICAL developments have a way of turning up work for materials which appeared to be of little if any practical value when they first became available. Such elements as tungsten, molybdenum, manganese, and chromium, for instance, were once curiosities; modern steel manufacture has translated them from that dubious state into positions of importance and value as alloying agents. The story of aluminum is an even stronger illustration of the point; when processes of recovery permitted its production on a commercial scale, uses had to be invented for it. How effectively that invention was carried out needs no elaboration.

Times of international stress often concentrate this kind of development, as they necessitate both the utilization of substitutes for conventional materials and the exploitation of accessible but low-grade resources which in ordinary eras would be ignored.

Interest hence attaches to a way of recovering metals from low-grade ores which for some years has engaged H. C. Weber, '18, Associate Professor of Chemical Engineering at the Institute, and has been brought to pilot-plant application in the extraction of boron. Professor Weber has also used the method in extraction of beryllium, zirconium, titanium, and tungsten on a laboratory scale. Some important uses for this group of metals are already known; technical advances, military exigency, and the availability of workable supplies of the metals themselves might be expected to disclose others.

Beryllium is used, for example, in an alloy with copper for springs which must carry electric current, as well as for switch contacts and similar parts. Zirconium, for which but little application has been found until very recently, now appears as a plating on the anode of certain radio tubes. Boron itself is extremely hard, the metal in the pure state scratching glass. It is also resistant to corrosion and might therefore be used as a plating to give other metals a hard corrosion-resisting surface.

Titanium tetrachloride is used in military smoke screens laid down by airplanes. Boron trichloride, which can be made inexpensively by Professor Weber's process, as can titanium tetrachloride, conceivably might be used in the same way. By the hydrolyzing of titanium chloride, titanium oxide — valuable as a pigment in paint — is readily produced.

Low-grade ores of these metals are available in this country; in them, concentration of the mineral itself is often pretty low. Beryllium, for instance, makes up only about 6 per cent of beryl, the ore in which it is found. For such ores the Weber process appears to be especially applicable, since it permits "boiling out," as a chloride, the desired small fraction of metal and easily discarding the unwanted large residue.

Essentially, the new process consists of an improved, simplified technique by which the metal is volatilized as a chloride directly from the ore. The ground ore is mixed with carbon, and chlorine or hydrochloric acid gas is passed over the mixture, bringing the metal off as a chloride which is then reduced. Practically complete recovery of the chlorine is possible, and the apparatus involved is very simple. Controlling the ore-carbon mixture permits operation at relatively low temperatures and thus obviates the expense of attaining and maintaining high heat levels, as well as the expense of the corrosion-resistant apparatus which would be necessary under high-temperature operation. In this respect, the method is an advance over earlier chlorination processes.

Roll Call

IN the opinion of a learned national committee, a century and a half of the United States patent system have witnessed at least nineteen inventions about whose basic importance there is close agreement, the choice being limited to patents which have now reverted to the public.

Seven of these inventions were concerned with communication, if we use the word in its broadest sense as signifying the interchange of thought; three either revolutionized or founded means of transportation; and half are credited with having laid the foundations upon which new industries have subsequently been erected.

The list: air brake, airplane, production of aluminum, cotton gin, incandescent lamp, induction motor, Linotype machine, motion-picture projector, oil cracking, phonograph, reaper, sewing machine, steamboat, telegraph, telephone, thermosetting plastics (of which Bakelite is an example), three-electrode vacuum tube, typewriter, and vulcanization of rubber.

Astronomers' Aluminum

MIRRORS upon which astronomers depend to concentrate the faint light of distant stars for study are the essential element in astronomy, for upon their reflective powers depends the ability of observatory telescopes to bring to the photographic plate record of what goes on in the sky. Thin films of silver on accurately ground glass surfaces are effective mirrors, but even more effective are films of aluminum. Silver's reflectivity is as high as 90 per cent in the visible range, but in a few months it drops off to 60 per cent of the original value because of tarnishing. Aluminum, on the contrary, retains its initial reflectivity of 88 per cent for a much longer period, and has the added value of a 60 per cent reflectivity in the ultraviolet, where silver drops to but 8 per cent.

For these reasons, there is interest in the success recorded for apparatus built at the Institute to evaporate aluminum on mirrors for Technology, for Harvard Observatory, and for other institutions. Already Harvard astronomers have aluminized fourteen mirrors — including two of 60-inch diameter — in the high-vacuum stainless-steel tank housing filaments from which the aluminum is evaporated.

Constructed under the direction of John Wulff, Associate Professor of Physical Metallurgy at Technology, the evaporating apparatus stands 9 feet high, the tank having a volume of 175 cubic feet. For the evaporation of metals essential to the depositing of the thin film necessary in manufacturing mirrors, high vacuums must be maintained. Hence the tank is of welded construction and can be brought to a vacuum of 10^{-2} millimeters of mercury in half an hour by means of a mechanical pump. In two hours, a vacuum of 10^{-6} millimeters of mercury is attained, with aid of a diffusion pump but without the use of a refrigerant, and the rate of leakage is so small that after twenty-four hours a vacuum of 10^{-5} millimeters of mercury is maintained. Tracking down and repairing pores in the welds holding the stainless-steel sheets together was the slowest part of the construction of the apparatus and had to be done painstakingly to make possible the holding of the vacuums. Working vacuums such as these are clearly to be rated as in the skilled-artisan class; the ordinary radio tube, for instance, is evacuated to a pressure of 10^{-3} or 10^{-5} millimeters of mercury. In the aristocracy of experimental vacuums, which are secured in closed glass systems with the aid of absorbents and refrigerants, a vacuum of 10^{-8} millimeters of mercury heads the list.

Evaporation is carried out from seventy-two tungsten filaments charged with aluminum. These are arranged on the periphery of the disk to be aluminized and at the distance above the mirror necessary to produce a film of uniform thickness. All the filaments can be evaporated of their charge to make an opaque aluminum coating in from two to four hours, during which the evacuating pumps are kept in operation.

The glass disks themselves must be carefully cleaned before being treated if the mirror is to be durable. After being cleansed and dried, the disks are placed in the tank and are bombarded by positive ions in a partial vacuum for a time, in order to free the surface of residual adsorbed films. Then the tank is evacuated to the best vacuum possible, and evaporation is started.

The apparatus built and set up in the Harvard Observatory comprises a tank six and a half feet in diameter and five feet high. A smaller outfit with a 30-inch tank is installed at Technology and has been employed in researches on the evaporation of metals and the coating of surfaces. Deposition of silver coatings on sheet steel with or without intermediate layers of plastics is a subject of particular interest, and research done on it with this apparatus at Technology has provided data serving as the basis of a large developmental project at the Bureau of Standards. The 30-inch tank is also being used to make extremely fine aluminum powder for use in silicosis therapy and to produce special surface treatments on steel and other alloys. Other evaporating tanks of the same pattern and purpose exist in California, where a 100-inch tank has been built and a 200-inch one is in construction. In Michigan and in Texas, 72-inch tanks have also recently been built for aluminizing.

United States Army Air Corps

George W. Goddard, major in the Army Air Corps and chief of its photographic laboratory, with the 60-inch telephoto aerial camera used in taking the high-altitude eclipse photograph shown opposite. A filter was used, with lens stopped at f:32 and shutter at 1/300 second.

Night Landings on Water

A SYSTEM of radio-controlled fluorescent lights mounted on rubber floats to outline landing areas for seaplanes on ocean, lake, or river was tested recently on the Anacostia River by the Civil Aeronautics Authority. The new lighting system is said to have the advantages of an economical battery-operated light source, a supporting float which would not be hazardous to navigation, and remote control by radio. The lights may be arranged on water in lines to indicate a seadrome, in the same manner as boundary and contact lights are used on a land airport. For large seadromes several "runways" can be outlined on the water, so that a plane landing from any direction can head into the wind. Thus at permanent bases, where extensive operations would be necessary, lines of lights could define several lanes 500 feet wide. For temporary or remote bases, where portable equipment might be used, one row of lights would be considered sufficient.

The contact lights would be in three colors — red, green, and gold — giving the pilot positive indication of his progress down the runway. The system calls for two green lights at the approach to the landing lane, with the remainder of the line in gold except for two red lights marking the end. In addition to the lane contact lights, seadrome boundary lights flashing red would be floated about 1,000 feet apart as a warning to ships that the space is restricted for planes. These lights would be kept burning all night for emergency landings.

The light source to be used in this system is a fluorescent lamp of high efficiency, powered by light-weight dry-cell batteries. The electrical system has a low battery drain, and it is said that a steadily burning contact light would operate for sixty days if illuminated for a nightly average of five one-hour periods. The flashing red boundary units are estimated to be good for 2,500 hours of continuous operation.

The rubber floats for these lights are in the form of large doughnuts, with vertical black and yellow stripes for daylight identification. The floats are inflated with air only slightly above atmospheric pressure, which small amount of inflation has the advantage of keeping them stable in choppy seas. Stability is also increased by the structure of the walls of the floats, which change in shape to meet the shifting stresses caused by passing waves. Tests included contact with fast boats, which revealed that the resiliency of the floats minimizes the possibility of damage by collision.

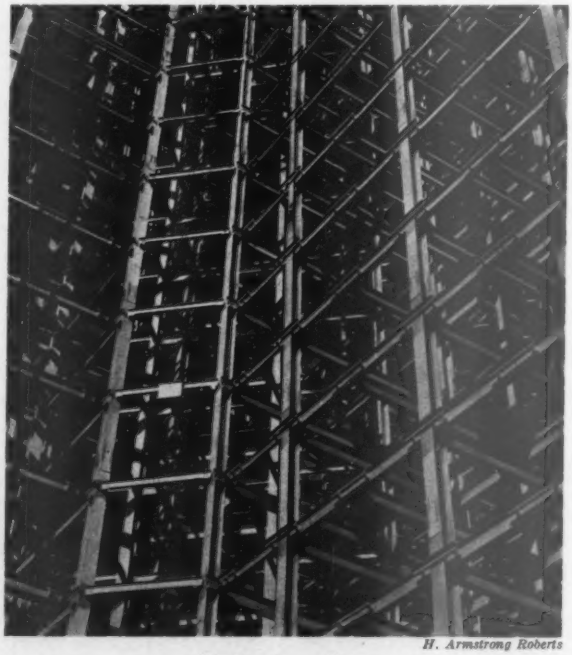
The radio control of the system would permit quick selection of the proper landing lane and an indication of wind direction by manipulation of the red and green lights. The radio system is designed to operate to a distance of six miles. Each light unit contains an individual radio receiving device mounted inside a metal housing which also includes a compartment for batteries and the operating equipment of the lamps. The control signals are picked up by a small whip antenna mounted on each unit.

Interatomic Gauge Lengths

USING interatomic distances of a hundred-millionth of an inch as gauge lengths, a new x-ray method of measuring the internal stresses in a metal is under investigation by John T. Norton, '18, Associate Professor of the Physics of Metals at Technology.

The fact that it is nondestructive and can therefore be applied directly to a metal member at work as part of a machine or building, makes the new technique of distinct importance. Devised by German investigators at Stuttgart and Düsseldorf, this application of the versatile x-rays has been under study at Technology for some months, the American researchers' purpose being to test previously attained results, to seek improvements in sensitivity, and to find ways of applying the method in the welding field, where testing techniques are particularly needed.

This means of actually measuring the magnitude and direction of the principal internal stresses by consideration of a point on the surface of the metal relies upon the fact that when a metal is elastically deformed, the distances separating its atoms vary just as do the distances separating points on its surface. By measuring strain — or changes in these distances — and assuming the elastic constants known for various metals, the investigator can readily calculate the stress. Extensometer methods hitherto used require two measurements. The first is of the specimen without load — a requirement hard to meet without dismantling a machine or tearing down a building. The second is of the specimen under load. The x-ray technique, however, requires only the second measurement, for the first which it uses — that of the interatomic distance in metals — is already known. Three x-ray diffraction pictures usually suffice, though four are necessary for a completely unknown case. The most useful application, Professor Norton feels, will be in the determination of stresses occurring in and around welded joints.



H. Armstrong Roberts

Steel in the sunlight

The Enduring Free Society

Will to Live, Sprung from Unity of Purpose among Vast Majority of Citizens, Essential in Withstanding Totalitarian Challenge; Faith in an Ideal Imperative

By James B. Conant

THIS is not a happy June in which to listen to a baccalaureate address. And, I may add, it is not an easy time in the world's history to deliver one. A speaker on such an occasion must by tradition say something about the future, and the future, today, stands menacingly before us. As the devastating news from Europe continues to roll in, ugly questions rise to the forefront of our minds — ugly questions with far-reaching implications. The future may be very different from the past; that is the possibility which confronts us. In times like these no one can hope to play the role of prophet. Even in taking a long-range view of the years ahead, as I propose to do, no one can speak with any confidence. Events of the next few months may well make any statement of mine today preposterous.

As I have recently stated, I believe this country should give immediate and effective aid to the Allies. We should, furthermore, press forward with our comprehensive program for rearmament. These steps seem to me to be essential — essential to prevent the destruction of our hopes. But I do not propose here to discuss this problem or any problems dealing with the immediate future. Rather, I assume these pressing questions will be answered. Today, I ask you to project your minds beyond the next few years. I ask you to contemplate the future a decade or even a quarter of a century hence. And, I may remark in passing, the passage of twenty-five years will bring you only to the stage of life in which we elderly people of my generation now find ourselves. Perhaps unfortunately for us, even at our advanced age we find our task is far from done!

It is not my intention, then, to consider the immediate issues before the country. I propose, instead, to examine a fundamental question which in a sense underlies all discussion of current problems. This question is: What type of free society can endure in a mechanized world of force? Notice, please — I say free society. The adjective reveals the kernel of the question. What do we mean by free society? you may well reply. I have in mind not only the political machinery of a republican form of government based on untrammeled universal suffrage. Even more important, it seems to me, are those free institutions which insure our way of life: trial by jury, the writ of habeas corpus, free speech and assembly, freedom of the press, freedom of religion.

What type of free society can withstand the challenge of a powerful totalitarian state? The answer in general terms is obvious: Only a highly efficient, industrialized nation which has the will to live can survive in this modern, ruthless world. Let me repeat — a nation which has the will to live. But this will to live, this determination to survive, must in turn spring from a unity of purpose among a vast majority of our citizens. There must be coherence among the inhabitants both young and old — a coherence based on a common tradition and motivated by faith in an ideal; a rational and emotional loyalty to a way of life, a type of society, which feeds the hopes and ambitions of succeeding generations of young men.

The questions which I shall raise about the future of the United States will not be primarily either political or economic; they will be questions which concern the social organization of the country. They will not involve an appraisal of the national situation at this moment but a consideration of the continuous development of our unique national life. In particular, I am going to ask you to consider what kind of a society can, on the one hand, be effective as a highly industrialized state and, on the other, preserve enough individual freedom to satisfy the needs of those nourished in our great tradition. In short, I am going to talk about both men and machines, about liberty and technology. I am going to talk about the structure of society as it develops through the generations.

Let me remind you that our modern world had its beginnings in the Fifteenth Century. Since then three concurrent developments have gone hand in hand: the rise of modern capitalism, the development of science, and the evolution of free institutions. There are a multitude of striking interconnections among these three paths of development of the Western race — industry, science, and liberalism. Without science neither a business civilization as we know it nor the social philosophy of liberalism could have come to pass. And, conversely, without liberalism science could not have blossomed and endured.

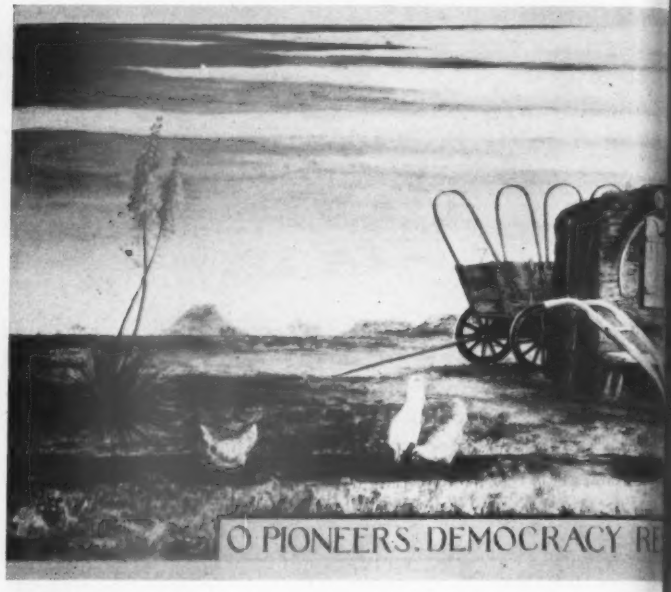
You have been educated in the sciences. A majority of you, I suppose, will enter some branch of the engineering profession. As engineers you will be working at the interface between science and society — an interface where there has been some friction, one must readily admit. This friction has been only a necessary concomitant to an essential interaction. My mechanical analogy may be false, however, for this boundary between the activities of man as a scientist and man as a social animal is dynamic. There is no stationary wall; above all, there are no impenetrable layers. The interchange across the dividing line has been rapid and significant, fruitful to science, fruitful to industry, fruitful to society. As citizens, all of you will play some

part in determining the course of events in your native lands. But as engineers, working at this interface between science and society, your task will be peculiarly important. Furthermore, as scientists, you will have a special stake in a democratic form of government, a special stake in maintaining freedom, a special stake in sustaining the pioneer.

Let us take up first the relation between science and industry, for your careers will be largely in this field. It is important to have a clear idea of the developing relationship over the years between scientific progress, on the one hand, and industrial expansion, on the other. There are some strange notions on this point. For example, a distinguished philosopher stated a few years ago that "by and large, the economic changes of recent centuries have been parasitic upon the advances made in natural science." I humbly suggest that he chose the wrong biological metaphor. If we view the history of science in relation to the history of society, we are led to characterize the relation of industry to pure science by the word "symbiosis," which means living together, not by the word "parasitism," which implies a host and a devouring parasite. I trust I am not insulting either your intelligence or your scientific training by reminding you that the common lichens on the rocks afford an example of symbiosis. A colorless plant akin to a fungus lives with a minute green unicellular organism, an alga. The green plant manufactures the food for both by photosynthesis from the air; the colorless plant lives on this ultimate source of energy but, thanks to its tough tissue, protects and stabilizes the manufacturing unit. Without *both*, we do not have a lichen. Which is more important, the fungus or the unicellular green organism? As scientists, you will all readily declare this to be a meaningless question. If you were either an alga or a fungus, however, you would feel differently about it.

As a pure observer, you can regard the vegetable world, at least, without prejudice and emotion. But when we come to the animal world, particularly the world of human activities, how different is the story. Which has been more important, the industrialist or the scientist? If this question were suddenly sprung on each of you, I would be willing to wager almost all would answer promptly. Only a few would reply that this question had no meaning. I do not know or care how many of you would favor the pure scientist and how many the businessman. My point is this: Only by an extreme effort of the will can we judge a human situation without prejudice or emotion. Yet such effort must be made if we would understand the past and construct an ideal for the days to come. Straight thinking, not wishful thinking, is in demand today.

Perhaps you will grant me that the connection between society and science is one of symbiosis. Still you may feel that the relationship is one sided. You may argue that while pure science has affected industry to a great degree, the influence of society on science has been almost negligible. Let me give one example to combat this view — a view which has been widely circulated. Let me cite one way in which the development of science has been conditioned by advances in technology. Take the history of that awe-inspiring branch



of physics known as thermodynamics. It was just about a hundred years ago, namely, in the 1840's, that Joule performed his famous experiments on the mechanical equivalent of heat. He was not alone in these inquiries. Many others at the same time were concerned with similar problems. Joule's biographer has an explanation for this sudden interest in one branch of physics. ". . . To the locomotive," he writes, "must be attributed the birth of that philosophical interest respecting heat and work which immediately followed its general introduction. . . . The locomotive is obtrusive; it will be seen: and by 1842 locomotives had obtruded themselves well over Europe. . . . demanding the attention even of philosophers who had previously studied nothing lower than the planets." In this interpretation Joule's biographer illustrates a fundamental point. Here we see the development even of theoretical physics conditioned by current technological inventions. Here is one essential element in the interrelation of science and society.

So much for the interconnections through the path of industry. Now look for a moment, if you will, at another equally important aspect of this complex web of interrelationships. Consider the effect on science of the form of society in which the scientist lives. Consider the influence of the type of political and social organization of a nation in which science is developing. We scientists often fail to realize the debt that both science and industry owe to that movement which gave us our present degree of personal freedom. We fail to appreciate, perhaps, how much we owe to the release of human energies — a release made possible by the growth of free institutions in every Western nation. Do not let the momentary triumphs of the totalitarian states fool you. Do not let your eyes be diverted from the fact that three paths of development — political freedom, free enterprise, science — run parallel.

Science may temporarily appear to bloom under the dictatorship of a Hitler or a Stalin, but no one who has known the history of science can fail to prophesy the

Federal Works Agency—Section of Fine Arts

"A pioneering classless society is essential if we are to remain both efficiently industrialized and at the same time free."
A mural by Peter Hurd in the post office at Big Spring, Texas

ultimate withering of the scientific tradition in a totalitarian state. Progress in science has been made by the unusual person, the unorthodox individual. He cannot survive a regimented social order. If you value a continuation of scientific advance either in pure science or in technology, I do not see how you can fail to be concerned for the preservation of both free initiative and free democratic institutions. It seems to me illogical for a scientist to be even quietly resigned to the possibility of a highly organized paternalistic state.

Let me hasten to add, however, that I am not arguing for the *status quo*. Rather I am urging that our picture of the future of this country conform to an old American ideal — a unique form of society without a ruling class. Many fail to realize that the essential element in our past has been the relative classlessness of our social order. A rich continent, free lands, a rapidly expanding industrial civilization, immigration from Europe, the ideals of Jefferson and his followers, the democratic spirit of the frontier — these were the factors which made the history of man on this continent during the last 150 years without parallel in time or place.

But, you may ask, how about the landed aristocracy of the South in the days before the Civil War? Of course no realistic study of the American scene could fail to reveal that in some sections of the country, there have been for years classes based on inherited position. Not only in the South — ever since the heyday of the Federalist party a ruling class has been perpetuated with more or less success in some northern cities of the Atlantic seaboard. In some localities society has been stratified, to use a geologic metaphor. But these cases are not typical. Until the turn of this century, at least, anyone born in the lower levels of such a stratified society could move to another younger section of the country. There he could win a career for himself, irrespective of his inherited position. Both the free lands of the West and the expanding industry of the East made society fluid. During the last half of the Nineteenth Century, the mobility of the social structure reached a maximum. Since 1900, however, social mobility has decreased. To me this is a disturbing fact. In pioneer communities, careers were freely open to the talented — the talented of all sorts. Who can claim that this condition is true today? More and more the structure of our social order has come to resemble that of a sedimentary mountain with many impenetrable and static layers.

Now, to carry on the American way of life, a high degree of social mobility is absolutely necessary. We must have sufficient flexibility in our social order so that individuals of each generation can seek and find their own levels. We must have the maximum of opportunity, the minimum of inherited privilege. A pioneering classless society is essential if we are to remain both efficiently industrialized and at the same time free.

To be sure, the socialists, as well as any who yearn for a totalitarian state, will reject my line of reasoning out of hand. So likewise will any who have come to believe that civilization depends on the upbuilding of a privileged class of wealth and culture. Both ideals, the socialistic and the patrician, appeal to many people — rarely, however, to the same individual. On paper the socialistic state appears attractive; in historical retrospect we find that a ruling wealthy class has, at times and places, enriched our civilization. I remain unconvinced, nevertheless, that the collectivistic trend in this day and age can lead to anything but tyranny. And, given the history of the last 150 years with the emphasis on democratic ideals and the growth of universal suffrage, I believe the perpetuation of a privileged class may well be the eventual cause of social chaos. From this chaos will come dictatorship, a totalitarian state, the end of freedom. Examine the history of Germany and of Italy, (*Continued on page 392*)

Technical Men in a Republic

Special Characteristics and Duties Are Required by Our Institutions from Those Scientifically Trained

By Henning W. Prentis, Jr.

YOUNG men now about to make a frontal assault on the ramparts of the American system of free enterprise find the moats and outlying works of that citadel already swarming with a huge army of idle men and women — some of whom, sad to say, would destroy the entire structure if they cannot gain its heights. Under such circumstances it seemed to me peculiarly fitting to discuss the characteristics and duties of technically trained men in a republic. Certainly the M.I.T. has few, if any, peers in its particular field of education. So when I make bold to add several R's to the three old R's of primary-school days, none of you will conclude that I am underestimating the prestige of your great institution.

For things that I am anxious to remember, I have always found it helpful to install cranial hooks on which to hang them. Perhaps these baccalaureate R's of mine may serve in that capacity for those of you who may decide to provide temporary mental pigeonholes for my observations. All save the first R have suggested themselves as I have contemplated the stupendous contributions that the scientific mind has made to the comfort, pleasure, convenience, efficiency, and scope of modern life and thinking: marvels such as the iconoscope, our great reflecting telescopes, the photoelectric cell, the vacuum tube, the cyclotron, the gyroscopic steering devices on our ocean liners, together with those newfound theorems dealing with the behavior of electrons, neutrons, and the various other members of the rapidly growing "tron" family.

My subject itself includes the first R. Nowadays men speak constantly of our American democracy, although the word "democracy" does not appear anywhere in either the Declaration of Independence or in the Constitution of the United States. A "Battle Hymn of the Democracy" by Julia Ward Howe would certainly have mystified our Civil War grandfathers, for a democracy is a form of government in which all important public questions are determined by the direct will of the current majority. Such government has never proved successful, as our forefathers knew. They took great pains to set up a republic instead — in other words, a representative democracy, in which the expression of the popular will was everywhere cushioned by representative rather than direct action, and the inalienable rights of the minority were sedulously safeguarded by a written constitution. As James Madison wrote in *The Federalist:* "Democracies have ever been spectacles of turbulence and contention; have ever been found incompatible with personal security, or the rights of property; and have, in general, been as short in their lives, as they have been violent in their deaths."

I make this distinction not merely in the interest of clarity of definition. There is a vital point involved: In a democracy popular passion, aroused by the tongue of the demagogue, is substituted for the rule of representatives, selected by the people presumably for intellectual capacity and character. Hence if we can successfully perpetuate the basic principles of a republic in this country, the opportunity for technically trained men to make their leadership effective in the promotion of the commonweal will steadily increase as science progresses.

In recent years the very word "democracy" has acquired such a favorable connotation in the public mind that collectivists are using it cleverly in divers ways to cloak efforts intended to undermine the system of checks and balances and the distribution of powers among Federal, state, and local governments, so laboriously devised by the founding fathers of this republic. Not only radicals but far too many well-meaning persons of influence and power are today only too willing to take questionable short cuts to cherished social objectives, under guise of the so-called democratic process. Witness the unmitigated rule of the majority provided by the National Labor Relations Act, under the provisions of which the minority has no constitutional system of checks and balances to afford it protection. In addition the right of freedom of speech is denied employers. One can be a firm believer in collective bargaining, as I am, and yet be deeply concerned over the increasing tendency of government to trample on the rights of individuals and minorities in clear violation of the principles on which this Republic was founded and on which alone it can endure.

Every action that has been taken to change our Republic to a democracy has been justified, I believe, on the ground that humanitarian ends will allegedly be served thereby. Thus we are brought face to face with the situation described by Louis D. Brandeis in these words: "Experience should teach us to be more on our guard to protect our liberties when the government's purposes are beneficent. . . . The greatest dangers to liberty lurk in insidious encroachments by men of zeal, well-meaning but without understanding." Not merely as a patriotic duty but also as a matter of enlightened self-interest, technically trained men should be particularly alert to guard well the foundations of individual freedom and opportunity that the American Republic provides.

Any man who claims to be educated should have acquired a certain storehouse of facts and the ability to marshal those facts so as to think straight. But a technically trained man, it seems to me, should in

addition be able to maintain a peculiarly high degree of receptivity to new ideas and new impressions. Like V. K. Zworykin's iconoscope, his scientific education should have made his mind exceptionally alert to every new experience. Such a man will be the antithesis of that large group of human male animals who merely vegetate through life, who keep the same old plates in their mental cameras day after day until the images are so blurred and foggy that clear perception and stimulating thought become impossibilities. To the man who daily unrolls a new film behind the lens of his mental kodak, life never loses zest and intellectual stimulus. Out of his kaleidoscope of new impressions, there constantly form new patterns of thought, new concepts. The receptive mind, the iconoscopic mind, alone provides the basic raw material for that rarest yet most important of all faculties for the individual and the race — creative thinking. No government commission will ever write a great book, no committee of your Alumni Association will ever paint a great picture, no labor union will ever compose a symphony, no chamber of commerce will ever invent a radio, no college faculty will ever conceive a theory of relativity, no graduating class will ever compose a sermon that will move the minds and hearts of men. The individual, in the last analysis, accounts for all human progress.

Closely allied with receptivity is another R of higher education, reflectiveness. Just as the mirror of a huge telescope gathers and concentrates the rays of light from astral bodies millions of light-years distant and reflects them to the retina of the observer, so the trained mind receives countless impressions and then transmits them calmly to the eyepiece of reason for sorting, assembling, and co-ordinating, to the end that there may be order in thought and dynamic thinking directed to a productive purpose. Reflectiveness gives both breadth and depth to man's reasoning powers. In the words of that great engineer, John Hays Hammond: "The broader one lays the foundation, the higher one can raise the monument to achievement."

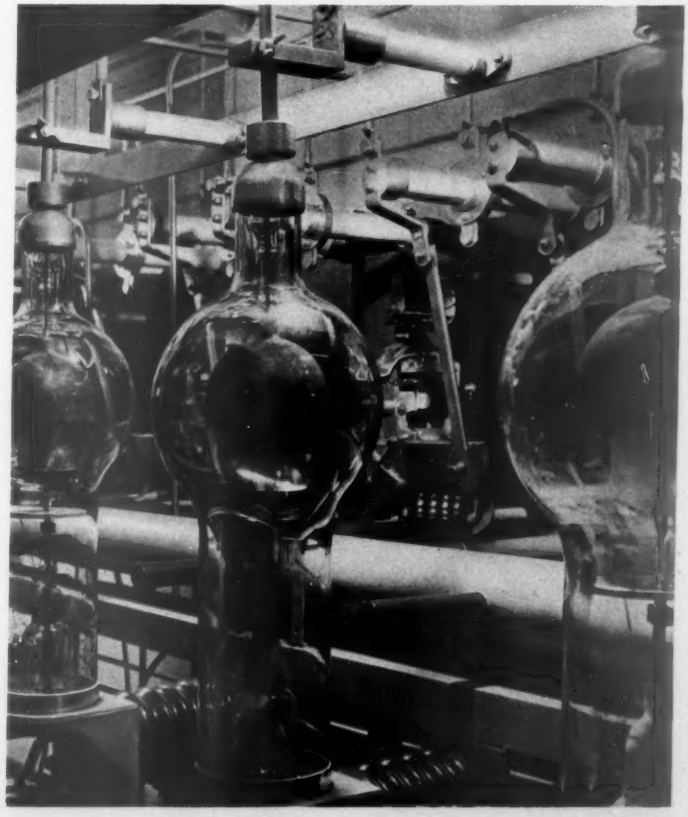
Resourcefulness is another outstanding characteristic of any man who is scientifically trained in the broad sense of that phrase. The mind of such a man is like a photoelectric cell — able to serve in diverse capacities, quick to adjust itself to the slightest external change, alert to the discovery and application of every possible approach to any given end. From a practical business point of view, I know of no factor more desirable or essential in a man than resourcefulness. A resourceful man is the joy of every executive — a never ceasing source of inspiration to the organization fortunate enough to count him in its midst. His vision makes supervision unnecessary. Like the vacuum tube, he can render useful service in countless ways. His is the type of mind that is not content to remain in the hollows of precedent but constantly seeks the high ground of new achievement.

Resoluteness — the will to make oneself the master of one's vocation or profession — is obviously a vital part of the armor of every technically trained man in the battle of life. No man can hope to make a material and spiritual success unless he has the grim determination to drive ahead no matter what obstacles he may encounter. This will to do may be likened to a mental cyclotron whose irresistible force, smashing the atom of indecision, liberates the electron of high purpose and thus releases the full dynamic energy of finely trained minds. The more one reads of the lives of men who have achieved distinction, the more one is impressed with the fact that without exception such men were endowed with an unusual degree of resoluteness. The career of Christopher Columbus is typical. In the museum in Seville, Spain, can be seen the old navigator's textbooks — the works of Herodotus and the *Travels of Marco Polo* — bearing annotations in his own hand on page after page. He schooled his mind with all of the technical resources at his command. On August 3, 1492, he set out in his three cockleshells from Palos and for seventy days sailed an uncharted sea with little but his own unconquerable spirit to support him. But his resoluteness never failed. Read those entries in his journal. In the face of a mutinous and superstitious crew, a failing supply of drinking water, and rancid food, day after day he recorded: "Monday we sailed due westward"; "Tuesday we sailed due westward"; until finally his resoluteness was rewarded when a flickering light on Watlings Island was discerned at two o'clock on the morning of October 12 and a new world was discovered. Constancy of purpose, resoluteness, willingness to work — these are the indispensable requisites of every technically trained man who seeks to leave his mark on his day and generation. Thomas Edison said: "I never did anything worth while by accident nor did any of my inventions come by accident. They came by plain work."

As an untutored layman so far as engineering is concerned, I have always marveled at the gyroscopic steering apparatus which I have seen functioning on our huge ocean liners. Once (*Continued on page 394*)

". . . The . . . tube . . . render useful service in countless ways."

Westinghouse



News and the State

Swifter Communication of Constantly Increasing Amounts of Information Leads to Important Social Consequences

By Frank B. Jewett

AN ALUMNI DAY CONFERENCE PAPER

WITH the physical elements on which electrical communication services and usages are based we all have some acquaintance. Likewise the general course and history of their development are reasonably familiar. As to both the elements themselves and our view of them, developments at the near end of the historical avenue, rather than at its origin, are of especial importance to us in this discussion. To tie matters together, however, and despite our general understanding, I should like hastily to sketch the factual sequences of physical development during the past century and a quarter — that is to say, from the period immediately following the Napoleonic wars to the present time. Following this I should like to point out one or two contrasts in the conduct of human affairs which appear to me of more than usual significance and which these new things have brought about. Understanding of the cause of these contrasts seems to me important if we are to understand and operate this modern world of ours — a world in which age-old passions have been implemented suddenly with hitherto unknown, and to a large extent untried, tools.

The first of the rapid means of communication which make possible the accomplishments we are discussing in this symposium was of course the electric telegraph. This was followed in fairly short order by the submarine telegraph cable across the Atlantic, and then by the telephone. When this third contribution of applied science to the art of communication was made in the latter half of the 1870's, the world had already gone quite a distance in linking itself together by electric telegraph lines and submarine telegraph cables. These had greatly facilitated its operations not only in the matter of transmitting news for general consumption but likewise in increasing the efficiency of all human operations dependent on the quick exchange of information. It is important to observe that the entry of the telephone into the world of its time meant the inauguration of a complete change in the *type* of communication available to man — a change of far-reaching future consequences. Through it, man was later to speak so that all could hear, and hear simultaneously.

Telegraph lines and submarine telegraph cables had provided what we may call the means for a quick record service — a service not dissimilar, except as to speed, to those services by which written or printed communications had always been transmitted from place to place and from person to person. In a word, telegraph service was and is analogous to postal service. It transmits information deciphered by the eye and is a service in which some element of delay is not only present but tolerable. It does not in general involve the quick interplay of question and answer which is the basis of spoken intercourse.

The telephone, for the first time in man's history, gave opportunity not only for spoken communication at a distance but likewise for a service far swifter than any previously available. Even the earliest developers of telephony in the United States saw the possibility that through science the telephone could in time become essentially a no-delay service and thus make it possible for you and me, wherever we might be situated, to carry on conversation with some distant person on demand and without delay. Here in the United States we have already gone a long way toward reaching this ideal — a far greater distance here than anywhere else in the world. There is still a long way to go, however, but there are no evident insuperable obstacles in the path.

Dependence upon wires alone for the transmission of the electrical energy needed in telegraphy and telephony presented some hard hurdles — technical, economic, and political. For this reason the appearance of the next agency, radiotelegraphy — with its presage of radiotelephony — and the building up of radiotelegraph service across the water, between continents, to inaccessible places or places of little traffic, was a great event. Equally, if not more, important from a social point of view was the fact that radio for the first time provided the means of enabling people in mobile objects to be put in instant communication with people in other mobile objects or at distant points on land. Then came the radiotelephone and immediately thereafter followed the beginnings of the broadcasting art. More recently we have seen developed the instrumentalities for transmitting pictures from one point to another, either by wire or radio channels. More recently still we have seen the beginnings of the art of transmitting instantaneously pictures of moving events, that is, television.

At the same time that all these things have been going on, the art in each transmitting medium has been so improved that today, for both telephony and telegraphy in all their varied forms, the physical facilities which scientists and engineers have placed at the disposal of operating agencies can be connected together in any desired way; a usable channel of adequate communication from the point of origin to the point of destination may be, and frequently is, a conglomerate of wire and radio.

In a free and peaceful world the possibilities inherent in these great applications of science — these various modes of instantaneous transmission by wire and radio —

would normally have found their natural level. This level of proper usage would be one determined solely by questions of cost, convenience, and reliability. But we are not living in a free world, and hence many of the uses to which these instrumentalities are put are tortured things and not those which have developed as a result of the interplay solely of economic and physical laws.

One of the obvious early advantages of radiotelegraphy, for example, was the facility it appeared to afford of bridging the gap from point of origin to point of destination without the necessity of paying attention to the intervening countries over which it passed. To send a telegram from Boston to Bucharest wholly by wire methods, one had to employ a cable which landed in France or Italy. There the message was transmitted to a wire line which of necessity had to cross several countries, in each of which it was subject to the troubles and controls which those countries might see fit to impose. If, however, one could use a radio transmission capable of bridging the distance from Boston to Bucharest, what the intervening countries thought about the matter made no difference. Of course there are ways by which they might maliciously interfere with the passage of a radio message, but that is a game at which two can play and so, in ordinary times, is taboo by tacit consent.

On its face, radiotelegraphy seemed like a step forward to a more perfect world of free intercourse between free terminals. What we did not foresee was that free terminals might not always be free. We are today facing for a large part of Europe, and for the rest of the world for that matter, the same censorship and destruction of our direct means of communication by radio that we foresaw with regard to our wire transmission channels.

About two years ago, I was in Germany and was amazed by the freely expressed attitude of Germans toward the use of their mass communication facilities. As with everyone else, their principal means of reaching the mass of their population instantaneously was by radio broadcast. They could not, however, use this means of reaching their own people without simultaneously broadcasting to their neighbors, nor could they, even by the most severe penalties, prevent some of their population from listening to broadcasts from abroad. Most of those with whom I talked made no bones about the fact that no totalitarian state could tolerate the potential dangers to its existence inherent in such a situation. To overcome the obstacle, they had set themselves the task of supplying a wire-broadcast receiving set to everyone they thought it necessary to reach, so that in time all other receiving sets could be abolished by fiat and penalty. When this time arrived, the German population would be in position to receive only what they were designed to receive by way of information, and outside countries would receive nothing. Per contra, Germans would be prevented from receiving undesired information from outside the borders of the country.

To an American brought up in a philosophy of free speech and full information, this scheme was quite appalling.

So much for the physical things which enable us to transmit and disseminate quickly a vast amount of what we have come to call news or information, even though many may think that much of it belies these designations. How is this vast flood of informative material we are getting, almost coincident with the events it describes, likely to influence us in our actions and reactions? Are our actions and reactions to events transmitted to us in this fashion likely to be widely different, either individually or collectively, from the actions and reactions of our forebears in corresponding situations?

If we go back in time and contrast the situation which existed in the period of the Napoleonic wars with the situation we now have, it seems to me that we can hardly escape the conclusion that modern communication is more likely than not to produce a different individual and mass reaction to certain stimuli from that produced in our ancestors. Those of you who have read Caulaincourt's record of the ill-fated Russian campaign, and particularly that part of it which deals with the debacle of the retreat from Moscow, will remember the meagerness of Napoleon's information about affairs in Paris. More particularly, you will remember that those in Paris had little or no information about the campaign in Russia. Most striking of all is the account of Napoleon's return to Paris after he had decided to abandon his starving, freezing troops. As Caulaincourt reports in his daily diary of that trip, the thought which was uppermost in Napoleon's mind was that he must get back to Paris in advance of any news of the terrible disaster. He realized that only thus could he save his own situation.

To us today it seems almost incredible that no news whatever of one of the greatest military disasters in human history had reached any save possibly a few confidential officials in the capital of the country waging the war. The distance was only a thousand miles or so over land. Napoleon's faith in (*Continued on page 398*)

Impact of the news is intensified by the availability of the pictorial record. One type of wire-photo apparatus on exhibition at Technology's Alumni Day 1940.

M.I.T. Photo

World News Gathering

Transition from Phantasm of Today to Actuality of Tomorrow Is the International News Agency's Field

By James H. Furay

AN ALUMNI DAY CONFERENCE PAPER

So fast have world news events been moving that the actuality today, if mentioned two months ago, would have seemed like a phantasm. And yet the sudden transition from the phantasm of today to the actuality of tomorrow is precisely the field in which an international news agency must and does operate. Time was, not very many years ago, when a news agency was required infrequently to face what used to be called the "supreme test" of world news coverage and nerved itself for the shock. But nowadays so fast do world news events move and so rapidly may the whole face of the world be changed that the "supreme tests" of the efficiency and responsibility of an international news association have become frequent enough to be almost commonplace.

We who have been laboring in the field of international news coverage for a few years find in every such "crisis" a new and graphic illustration of the essential wisdom of the basic policy of the United Press and, indeed, of all the true international reporters — the reporting of the world's news as objectively as human frailty will permit. Real news reporting is the presentation for their own sake of the facts of what has occurred, without attempt to control the opinions which may arise as the result of those facts. Propaganda is the presentation for their own sake of opinions, in an effort to influence the thoughts of others. Fundamentally the difference between the two is this: News is fact, presented as fact; propaganda is opinion, frequently presented as fact.

Although the foregoing observations may seem trite and perfectly obvious to all newspapermen and probably to many newspaper readers, I am by no means sure that the average reader analyzes so closely the difference between fact and opinion. And therein lies the danger of propaganda. Muddled thinking and fuzzy differentiation between what is fact and what we may like to believe is fact sometimes cause a great many difficulties in keeping our heads cool and our thinking straight.

Perhaps it is unnecessary at this stage to explain that we in the United Press consider ourselves primarily reporters of fact. Our chief duty, as we conceive it, is to record the facts of the news as accurately and as objectively as possible, doing our best not to let whatever personal private opinions we, as human beings, may hold, influence or prejudice our statement of the facts as we find them. Of course perfect objectivity is impossible to achieve, and we do not claim any such superhuman result. But we do assert that we strive at all times to maintain an objectivity as complete as human nature will permit us to achieve. This sounds very simple. All the reporter has to do is get the truth in the news! But when the war correspondent is seeking the truth, particularly under conditions as they exist today, frequently he is seeking something so elusive that it can only be approached and not quite reached. Even when he gets the truth, he has surmounted only the first obstacle. Thereafter he must first state the fact accurately and objectively and then transmit it to the various centers of distribution which send it around the world.

Right here is where the reporter begins to encounter such collateral difficulties as censorship and propaganda. He is likely to encounter the propaganda during the effort to obtain the truth, and the censorship after he has obtained the fact and wishes to send it on its way to the newspaper readers of the world. Both propaganda and censorship present difficulties, but of the two I am inclined to believe that propaganda presents the greater. It appears always in plausible form and nearly always wears a smiling countenance. It is always put forth by masters in the art, and hence that it frequently deceives the unwary and the inexperienced should not be surprising. The reporter's best defense against propaganda is experience, based on actual service sufficiently long to enable him to have a clear idea of the location of the pitfalls. The task of spotting propaganda and evading it is not made any easier when we realize that most propagandists sincerely do not believe they are putting out propaganda at all. They are active partisans of the cause they serve and can hardly be said to view the facts objectively and impartially.

As for censorship, there is not much that a correspondent can do about it when he is accredited to a warring country which has imposed one. The newspaperman may not like censorships, but they are understandable in wartime even though the reporter may believe that they are pretty stupid and that in the end the truth will emerge anyway despite all the censors in the world. The censorship rules are there, however, for the correspondent either to obey or to violate. If he violates the censorship in a country at war, probably he must expect expulsion from the country if found out. He must therefore decide in his own mind whether the bit of news he wants to sneak through is sufficiently important to the newspapers of the world to be worth his own expulsion. It is not at all difficult to evade a censorship once or twice, but it is very hard to continue such evasion consistently.

Since the present war began in Europe, scarcely a day has passed that has not brought forth some difficulty resulting from censorship. At the outset, censors in Great Britain and France were much more severe and

inept and much less sympathetic toward the troubles faced by American correspondents than they have since become. Gradually conditions have improved. Nowadays most correspondents understand that they cannot send news of any movements of troops or naval vessels. Censors, too, have learned that it is wise to co-operate wherever possible with the newspapermen and to explain deletions as fast as they are made in dispatches on file. Some exceedingly ridiculous situations have resulted from the operation of the censorships. Not long ago we received a cable from our Paris office which, on receipt in New York, read textually as follows:

UNITED PRESS NEW YORK
END ITEM

That was all. The censor had deleted every word of the dispatch except the two which concluded whatever it was that the Unipresser in Paris wished to tell us. We were not deprived of a news item even then, however, because one of our ingenious young men promptly transmitted a humorous dispatch telling our client newspapers what the censor had done.

The newspaper correspondent of today, particularly the foreign correspondent, in courage, resource, stamina, intelligence, writing technique, and loyalty to the needs of the ultimate readers of newspapers need yield to none of his predecessors. In modern times there has not been a better or more consistent job of news coverage than that presented to American newspaper readers since the present war began. But the men and women assigned to posts in the foreign field have not achieved their successes by accident, nor was their presence at Warsaw or Helsingfors or Bucharest or Narvik or Amsterdam or Antwerp when tremendous news developments occurred merely fortuitous. They were where the news was breaking because of long and careful planning which began as early as the autumn of 1938.

These preparations were by no means confined to giving instructions to various bureaus regarding action to be taken if and when war began. The problem of city-editing the whole world does not consist merely of sitting and waiting for something to happen. The men who city-edit the world must act on the belief that almost anything can happen anywhere at any time and, as a matter of fact, usually does. Consequently they have to be ready for everything, or at least for as many things as they can think of. They face three primary needs: first, trained men and women for correspondents; second, intelligent and adequate location and direction of the manpower — this is what is meant by city-editing; and, third, communications for transmitting dispatches. All of these are important, but the third, communications, is by no means the least important.

Leased wire networks, as we know them in this country, do not exist in Europe. Long before the present war began, it was necessary for our people to explore all the potentialities and the speed of various forms of transmission from every part of Europe both to key cities in European countries which would probably be neutral and also to North and South America and to Asia. Numerous devices designed to facilitate and accelerate transmission had to be investigated and then adopted or discarded. Among these were wax cylinders for dispatches dictated by telephone in strange tongues; wireless printer telegraph machines; radio recorders; and the like. Thorough experimentation and exploration of methods such as these, consumed the better part of a year before we could feel satisfied that we had adequate and foolproof equipment ready for the emergency. Simultaneously staff men in key bureaus were constantly at work for months in border towns over the entire Continent, making such arrangements as were possible so that subbureaus might be established overnight in more remote places, if necessary, for passing copy across international boundaries. All news sources had to be checked and rechecked in order to avoid erratic reporting and to maintain accuracy.

This spadework was done quietly and as completely as possible. Its wisdom was demonstrated the instant war broke out. For with its outbreak, complexities which scarcely could have been foreseen were upon us. Most of the normal routes of communi- (*Continued on page 400*)

News transfer epitomized in a part of the Alumni Day exhibit at Technology — the teletypesetter apparatus in operation for the ultimate consumer

M.I.T. Photo

Radio in World Affairs

Great Social Values and Great Social Problems Are Generated as a Result of the Spread of Broadcasting

By Alfred H. Morton

AN ALUMNI DAY CONFERENCE PAPER

RADIO, the greatest scientific aid to the spread of intelligence among men, is a social product. Its descent is from the discovery of electricity centuries ago. More precisely, radio awaited Maxwell's mathematical demonstrations of the existence of electromagnetic waves and Hertz's experiments with the waves themselves. The list of contributors to the development of radio is a long one, which includes Thomas A. Edison, Guglielmo Marconi, Sir Oliver Lodge, Edouard Branly, Lee de Forest, and dozens of others. Marconi's spectacular demonstration, culminating in the transoceanic transmission from Poldhu, England, to St. John's, Newfoundland, in 1901, served notice that wireless telegraphy was a useful device, not merely a capricious toy.

It was the addition of speech to wireless and the subsequent distribution of millions of receivers among the peoples of the earth that made radiobroadcasting the greatest of mankind's ventures into mass communication, simultaneously raising perplexing social problems. For the first time it became possible for one person to speak not only to a single nation but to many nations. Practically all of us listened intently to King George VI as he announced quietly and gravely from London that for the second time in the lives of most of his subjects war had come to the British Empire. When the President delivered the first of his fireside chats, practically every activity ceased except that of listening. Who would venture to evaluate its psychological effect on a bewildered people, worn by years of deep economic depression?

We can only guess at the impact of an entire radio system devoted to consistent bombardment of a people with propaganda of the most intensely nationalistic character. With armies advancing and falling back in Europe, millions of Americans crowd about loud-speakers to hear the latest news bulletins or an official pronouncement by the spokesman for a foreign government. In other parts of the world, too, millions listen, but to different and frequently utterly biased versions of news from the front. Radio is clearly recognized as a supreme instrument for reaching great masses of the population. "Radio . . . has the advantage over all other means of forming public opinion through its ability directly to impress the whole of the people," says an apologist for a foreign system. He adds further that his government "made the radio the all-embracing instrument for proclaiming its theses which were to be binding for everybody," and that the party government "and broadcasting have become one insoluble unit." Another foreign official speaks of the medium's "close relation with the radio listener."

The social importance attaching to radiobroadcasting is clear. What gives us concern is the only too obvious fact that the instrument may be used for ill purpose as easily as for good. The untruth that poisons men's minds passes as freely from the microphone through the transmitter and out of the loud-speaker as the truth that shall make them free. Systematic dinning of false argument into the average listener's ear will eventually convince him of the argument's validity. The public attitude is one of general acceptance. The average listener is quite content to laugh at the quips of Charlie McCarthy or to be transported to another world by the mastery of Toscanini. He is also fair prey for men who possess vibrant voices, colorful phraseology, and a thorough understanding of mass psychology. Thoughtful persons have realized the immense power of radiobroadcasting to sway public opinion and to motivate mass action. Certainly not unaware of the problems raised by these powers is the broadcaster himself. All of us seek to determine the place of radio in a progressive democracy.

Let us pause here to examine some of the qualities that make radiobroadcasting a very special channel for the circulation of opinion and of news and other information. The powerful influence of radio is due largely to four characteristics: the vastness of its coverage, the intimacy of the message it carries, its appeal to the emotions as well as to the intellect, and, finally, its power to motivate action. There are in the United States, according to best estimates, nearly 40,000,000 radio receivers. In times of crisis, therefore, we may assume a potential audience of perhaps from 70 per cent to 80 per cent of the nation's 130,000,000 persons. A German estimate has claimed that more than 90 per cent of the population has gathered before loud-speakers to hear an address by Adolf Hitler. The intimacy of the message carried over radio has been experienced by everyone. The listener on the most remote homestead in Montana, more than 2,000 miles from the nation's capital, feels as close to the President of the United States, speaking from the White House, as if he were sitting directly opposite the President in the Oval Room. It follows, therefore, that he who has the ability to arouse the emotions of his audience has this power multiplied a millionfold by radio. His appeal is direct and is fraught with the full weight of personality so frequently lost in print. As for radio's power of motivating to action, we have only to recall incidents in certain parts of Europe.

Through a pattern dictated by these considerations, American broadcasters provide an impartial service in the supply of opinion and of news and other information,

as well as an amazing variety of entertainment and educational features. By comparison with the modern metropolitan daily or national press association, radio offers a small volume of news. In normal times — that is, in times of comparative peace — radio attempts to offer little more than summaries of the day's happenings. Frequently some of these are of a specialized nature, such as the summaries of market prices carried in programs directed at our agricultural population. For the content of these news digests radio depends mainly on the marvelously complete services of the nation's press associations. The National Broadcasting Company, for instance, has available the full services of the Associated Press, the United Press, and the International News Service.

Radio does offer special, and frequently elaborate, coverage of domestic and foreign news events, but it is highly selective. Our own staff men at Radio City and Washington and those of affiliated stations, men with a thorough understanding of the news needs and methods of broadcasting, are assigned to arrange and manage the pickups that provide listeners with such programs as the official utterances of the President, the Secretary of State, and other men in and out of official life; broadcasts of political conventions; and so on. Here radio offers the full texts of important addresses and rather elaborate descriptions of events of international significance.

Abroad, the National Broadcasting Company maintains offices at London, Paris, Basel, Rome, and Moscow to arrange for the transoceanic relay either of interesting entertainment or of important news. In all parts of the world, in addition, N.B.C. has what newspaper editors call "stringmen," that is, persons whose services can be commanded whenever some event of interest in the United States occurs in their vicinity.

The war in Europe has changed the normal news service of radio to a very considerable extent. One of the results of the war has been the pronounced increase in the number of programs relayed from the belligerent capitals and the frequent extension of the broadcasting day. As the scene of war shifts about Europe, the representatives of N.B.C. move along with it. For weeks a staff correspondent broadcasted from Helsingfors during the Russo-Finnish hostilities. Later the same man interrupted a stay in Berlin to go to Norway to witness the invasion of that country, subsequently reporting from Stockholm. It is not uncommon these days for radio networks to remain open twenty-four hours a day. I note that the daily schedule now calls for eight or more programs from Europe. These include broadcasts by N.B.C. staff men in London, Paris, and Berlin, with the occasional substitution of Rome for one of the three cities named. In addition the entertainment schedule is frequently interrupted to insert the broadcast of important news bulletins. Washington is a more frequent source of programs than usual, and our own foreign-news commentators are called upon several times daily to deliver digests of the news and to fit it into the background of facts that have gone before.

Westinghouse

Tower of the new KDKA station at Pittsburgh

I have up to this point dealt with both news and opinion as broadcast over American radio networks. The broadcast of news raises no special problem, but the broadcast of opinion frequently poses some surprising and delicate situations. I have pointed out the peculiar characteristics of radio — its power to stir the emotions of the listener and often rouse him to action. Reaction to broadcasts in the United States is further intensified because of the radio industry's organization. American radio-broadcasting is privately owned. It is operated in the public interest. The systems of Europe are, for the most part, government monopolies. Whereas American broadcasters derive their support from the sale of a certain amount of time on the air to advertisers of commercial goods, European organizations usually depend on license fees levied on all owners of radio receivers. In most European countries radio is more or less strictly controlled by government and is utilized to spread the official philosophy. Our own government has been content to use the facilities freely placed at its disposal by broadcasters, but it has carefully refrained from attempts at control. Governmental censorship is, in fact, expressly forbidden under the terms of the Federal Communications Act of 1934.

American broadcasting network companies have no editorial policy. News and expressions of opinion are, therefore, essentially matters of program material, the stuff of which radio is built. Thus a speech by Adolf Hitler in Berlin and a message to the British people by their prime minister are equally desirable as program materials. The program is good or bad according to the interest it holds for American listeners. The National Broadcasting Company carries Mussolini's addresses, reports from Moscow on the proceedings of the Soviet governing body, and the speeches by the premier of the French Republic all without prejudice. At home the widest possible circulation is given to the messages of all major political parties. The pronouncements of governmental leaders are an absolute "must" for the program departments of American broadcasting systems. Income-producing commercial programs are often canceled to make space in the schedule for such addresses. We also give liberal periods on the air to members of the opposition to state their case.

Some curious results follow, bringing into sharp relief the essential difference between a free radio and a (*Continued on page 403*)

News by Electric Waves

A List of Titles Significant in Communications, Subject of the 1940 Alumni Day Conference

COMPILED BY RUTH McG. LANE, VAIL LIBRARIAN

THE transmission of information by wire, cable, and radio is the accomplishment of that field of engineering commonly termed electrical communication engineering. Information is transmitted electrically in two ways: first, by means of guided waves over open wires and underground cables; second, by radio waves. Each method has its distinctive theory and structures, its special systems and applications. The literature of such a wide field is obviously almost limitless. This reading list attempts only to call attention to a few of the outstanding items published during a comparatively recent period. Because of the continuously rapid developments in electrical communication, much of the literature available is to be found only in current periodical articles.

I. ELECTRICAL COMMUNICATION — THE GENERAL SUBJECT

ALBERT, ARTHUR LEMUEL. *Electrical Communication* (2d ed.). New York: John Wiley & Sons, Inc., 1940. Pp. ix+534. $5.00.

HARLOW, ALVIN F. *Old Wires and New Waves; the History of the Telegraph, Telephone, and Wireless.* New York: D. Appleton-Century Company, Inc., 1936. Pp. xii+504. $5.00.

HERRING, JAMES M., and GERALD C. GROSS. *Telecommunications: Economics and Regulation.* New York: McGraw-Hill Book Company, Inc., 1936. Pp. x+544. $5.00.

II. GUIDED-WAVE TRANSMISSION

TELEPHONY — THE GENERAL SUBJECT

"A Quarter Century of Transcontinental Telephone Service": 1. "The Line and the Laboratory," by JOHN MILLS, '09; 2. "The Circuits Go Up," by H. H. NANCE and R. M. ORAM; 3. "Transcontinental Panorama," by F. B. JEWETT, '03, *Bell Telephone Quarterly*, 19:3–58 (January, 1940).

DANIELIAN, N. R. *A. T. & T.: the Story of Industrial Conquest.* New York: Vanguard Press, Inc., 1939. Pp. 460. $3.75.

GHERARDI, BANCROFT, and FRANK B. JEWETT, '03. "World-Wide Telephony — Its Problems and Future," *Bell System Technical Journal*, 11:485–519 (October, 1932).

———. "Telephone Communication System of the United States," *ibid.*, 9:1–100 (January, 1930).

"Technical Developments Underlying the Toll Services of the Bell System," *Bell System Technical Journal*, 15 (supplement to July, 1936).

CARRIER CURRENT — the medium which makes possible the simultaneous transmission of many conversations over the same wires or cables.

CLARK, A. B., and B. W. KENDALL, '06. "Communication by Carrier in Cable," *Electrical Engineering*, 52:477–481 (July, 1933).
This article describes a trial installation and experimental work.

COLPITTS, EDWIN H. "Recent Trends in Toll Transmission in the United States," *Bell System Technical Journal*, 16:119–143 (April, 1937).

KENDALL, B. W., '06, and H. A. AFFEL, '14. "A Twelve-Channel Carrier Telephone System for Open-Wire Lines," *Bell System Technical Journal*, 18:119–142 (January, 1939).

ROSE, ARTHUR F. "Twenty Years of Carrier Telephony," *Bell Telephone Quarterly*, 17:245–263 (October, 1938).

COAXIAL CABLE — concentric conductors applied to the transmission of many types of communication services and to large groups of communication facilities.

ESPENSCHIED, L., and M. E. STRIEBY, '16. "Systems for Wide-Band Transmission over Coaxial Lines," *Bell System Technical Journal*, 13:654–679 (October, 1934).

[STRIEBY, M. E., '16.] "A Million-Cycle Telephone System," *Electrical Engineering*, 56:4–7 (January, 1937).

STRIEBY, M. E., '16. "Television Transmission by Coaxial Cable," *Electrical Engineering*, 57:249–256 (June, 1938).

WAVE GUIDE IN PIPES — transmission of signals inside of pipes, and directional radio by means of horn radiators.

BARROW, W. L., '29. "Transmission of Electromagnetic Waves in Hollow Tubes of Metal," *Proceedings of the Institute of Radio Engineers*, 24:1298–1328 (October, 1936).

BARROW, W. L., '29, and L. J. CHU, '35. "Theory of the Electromagnetic Horn," *Proceedings of the Institute of Radio Engineers*, 27:51–64 (January, 1939).

SOUTHWORTH, G. C. "Hyper-Frequency Wave Guides — General Considerations and Experimental Results," *Bell System Technical Journal*, 15:284–309 (April, 1936).

———. "Some Fundamental Experiments with Wave Guides," *Proceedings of the Institute of Radio Engineers*, 25:807–822 (July, 1937).

SOUTHWORTH, G. C., and A. P. KING. "Metal Horns as Directive Receivers of Ultra-Short Waves," *Proceedings of the Institute of Radio Engineers*, 27:95–102 (February, 1939).

TELEPHOTOGRAPHY, OR FACSIMILE TRANSMISSION — transmission of stationary images of any graphical material and the recording of such images, accomplished by either wire or radio circuits.

"Home Newspapers by Radio," *Scientific American*, 158:334–335 (June, 1938).

IVES, H. E., J. W. HORTON, and OTHERS. "The Transmission of Pictures Over Telephone Lines," *Bell System Technical Journal*, 4:187–214 (April, 1925).

"News Pictures by Wire," *Electronics*, 10:12 (November, 1937).

"Pictures by Wire," *Electronics*, 12:13 (September, 1939).
Illustrated article descriptive of the various operating agencies.

Radio Facsimile: An Assemblage of Papers from Engineers of the RCA Laboratories Relating to the Radio Transmission and Recorded Reception of Permanent Images. Edited by ALFRED N. GOLDSMITH and OTHERS. New York: RCA Institutes Technical Press, 1938.

REYNOLDS, F. W. "A New Telephotograph System," *Electrical Engineering*," 55:996–1007 (September, 1936).

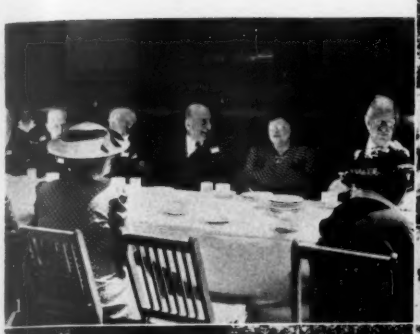
TELETYPEWRITER

HUNTER, HOWARD. "The Teletypewriter Helps the Police," *Bell Telephone Quarterly*, 18:161–180 (July, 1939).

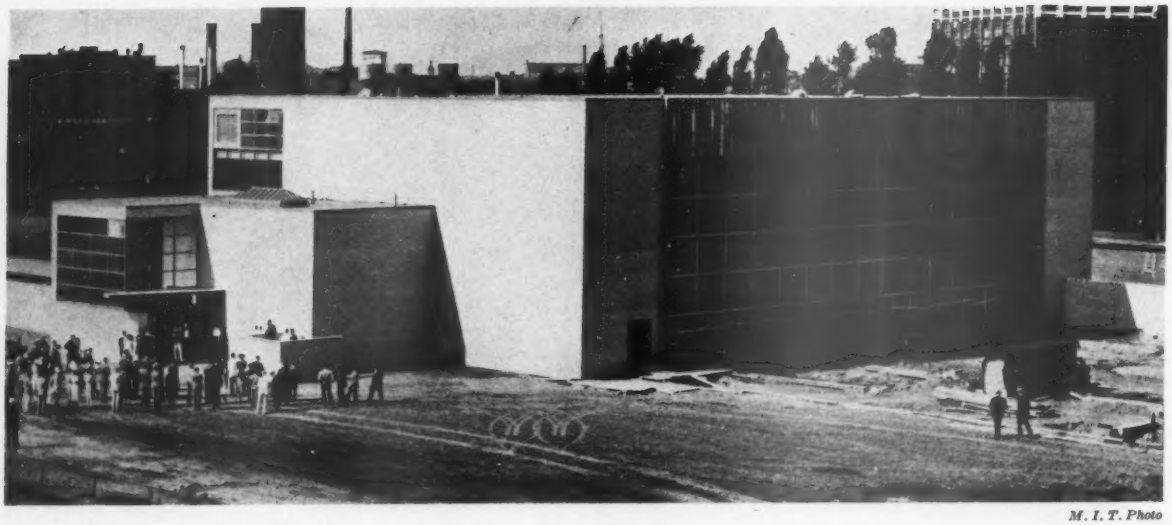
MARTIN, REX. "60-Megacycle Teletypewriter," *Electronics*, 10:10 (March, 1937). (*Concluded on page 390*)

Alumni Day 1940

A Camera Record



1. *Pierre S. du Pont, 50-year class speaker, at the luncheon.* 2. *1890 at table.* 3. *President Compton at the 50-year table.* 4. *Frank B. Jewett, '03, retiring President of the Alumni Association, does the honors as Carle R. Hayward, '04, heeds a request.* 5. *A cross section of 1935 discussing its first quinquennial reunion.* 6. *A cross section of 1917 engaged in general debate.* 7. *1915, 25-year class, at the luncheon.* 8. *Henry P. Cogswell, '73, left, lunches with George M. Tompson, '73.* 9. *David A. Shepard, '26, newly returned from London.* 10. *Henry E. Worcester, '97, right, President of the Alumni Association, chats before luncheon.* 11. *Philip W. Moore, '01, about to settle down.* 12. *Dr. Compton and Mrs. Prosser at christening of the new Lawley 110's.* 13. *Confabulation.* 14. *Transportation under discussion: Dr. Compton with Charles E. Smith, '00, and Dean Lobdell, '17.* 15. *Commander J. C. Bertino, '23, left, up from Buenos Aires, sharing long-distance honors with Henry C. Rickard, '26, from Buenos Aires, and Franklin Osborn, 2d, '11, and Edward N. Roberts, '26, from Potrerillos, Chile. Beside Commander Bertino, Laurence C. Shaw, '09, with electrical engineers including Edward L. Bowles, '22, in the distance.* 16. *Horace Ford, Treasurer, with Page E. Golsan, '12, center, and Page Golsan, Jr., '34,* 17. *At Class Day, Technology types parade.*



M. I. T. Photo

Second to None

Alumni Swimming Pool Is Dedicated, Expanding Facilities For Student Recreation at Technology

NOTABLY expanding the opportunities of Technology students for recreation and sport, the Alumni Swimming Pool was dedicated on Alumni Day. Second unit in the Institute's program for better facilities for building the man as well as the mind, the new structure is the first unit of the great recreational center planned for the future; in the judgment of competent critics, moreover, it is second to none in ability to serve the purpose for which it was designed.

The dedication ceremonies took place out of doors, at a corner of the new building, with the clean masses of the entrance wing as setting. Presenting the new structure to the Institute on behalf of the alumni body whose contributions, together with those of students and staff, made it possible, Henry E. Worcester, '97, new President of the Alumni Association and member of the Alumni Advisory Council on Athletics, spoke as follows: "On this 1940 Alumni Day, we are proud to dedicate Technology's swimming pool, the second unit in the Institute's building program to provide improved recreational facilities for Technology students.

"Last year on Alumni Day, the first unit — the field house and track on the land west of Massachusetts Avenue — was dedicated and named in honor of Frank Harrison Briggs, '81, a former chairman of the Advisory Council on Athletics. These units, known as Briggs Field House and Briggs Field, together with this swimming pool have been made possible largely by alumni generosity. They represent an investment of a half-million dollars. Nearly 80 per cent of the moneys used to build these units — the Briggs Field House, Briggs Field, and the swimming pool — were contributed by approximately 7,000 members of the undergraduate, staff, and alumni bodies. The remainder was appropriated from Institute funds.

"Technology's sports program, designed to benefit the average student by giving him healthful recreation through participation in sports, will be materially aided by these additions to the athletic plant. Through use of these units, Technology will be better qualified 'to build the man as well as the mind.' Thus we, as Alumni, have laid a firm foundation for future expansion of an athletic center which can better serve the recreational interests of all students.

"Preserved in this building is a stone from the steps of Old Rogers on Boylston Street, to perpetuate the rich traditions of the beginnings of Technology. The stone bears the following inscription: 'This stone from the steps of the first Rogers Building "The Tech on Boylston Street" 1864–1939.'

"Dr. Compton, it is my privilege as a representative of the alumni body to present to you this pool building, to be known as the Alumni Swimming Pool, which stands as a monument of alumni loyalty and interest in the welfare of M.I.T. and its future generations of students."

President Compton, in acceptance, stressed the vigor and ability of undergraduate operation of recreational activities at Technology, pointing out that undergraduate direction of

Above: *As dedication ceremonies opened on Alumni Day. The wall of the Class of 1923 garden begins at far right; temporary corridor to Barbour Field House, extreme left.*

undergraduate affairs possesses much value as training in the acceptance and handling of responsibility, and that thus it complements helpfully the work done in professional courses of the curriculum. Receiving the key to the new building from Mr. Worcester, he passed it on to Joseph H. Myers, '41, of Evanston, Ill., President of the M.I.T. Athletic Association, who received it as symbolizing the association's responsibility for the use of the building by future generations of students. At Mr. Myers' invitation, many of those attending the exercises then inspected the building, where members

M. I. T. Photo

Looking from the top of spectators' seats toward the Gargantuan south window, with the main pool ready for tiling, the completed smaller pool beyond, offices and coaches' control room at the end

of the executive committee of the Athletic Association were on hand to act as guides and to answer the questions of the visitors.

The structure thus dedicated consists mainly of a room 125 feet long, which houses a standard intercollegiate six-lane swimming pool 42 by 75 feet, a shallow practice pool 20 by 40 feet, and seats for 340 spectators. The larger pool is 7 feet deep at one end and 13 at the other; the smaller pool goes from 3½ to 4½ feet in depth. Detachable cast aluminum starting blocks specially designed for both free-style and backstroke events are to be installed. The depth of the larger pool permits use of a three-meter as well as a one-meter diving board. Showers and locker rooms for students and offices for the coaching staff are included on the first floor, and the second contains a dressing room and showers for women. The room containing the pools is dominated by the Gargantuan southern window which gives on a walled garden and sunning area, $10,000 for the completion of which have been donated by the Class of 1923. The window is so placed, and the building is so oriented, that during the middle of a winter day almost the entire water surface of the pool will be sunlit; in summer, however, the sunlight will strike only the deck on the south side of the pool.

The "firstness" of this building as nucleus of the great central structure ultimately to appear means that it has been so planned that subsequent units may readily be added to it as funds and needs appear. For the present, a temporary corridor connects it with the Barbour Field House near by. The architects, Lawrence B. Anderson, '30, and Herbert L. Beckwith, '26, have reckoned with future needs in their design for the recreational center as a whole and in their construction of the present section. Like their Briggs Field House, dedicated last year, the swimming pool building is impressive in its functional simplicity as a unit, and in the employment of lasting warmth of color and material. From the engineering and scientific points of view, the building expresses the co-operation of many Institute experts. James Holt, '19, Associate Professor of Mechanical Engineering, was consultant on the design of heating equipment; Walter C. Voss, '32, Head of the newly formed Department of Building Engineering and Construction, on materials and practices; Donald W. Taylor, '34, Assistant Professor of Soil Mechanics, on soil conditions; Kenneth C. Reynolds, '25, Associate Professor of Hydraulics, on problems in hydraulics presented by the design of the pool; Thomas R. Camp, '25, Associate Professor of Sanitary Engineering, who prepared the design of the filtration system; and Parry Moon, '27, Associate Professor of Electrical Engineering, who assisted on questions of illumination.

Incandescent lights, uniformly spaced in recesses over the pool and seating areas, with louvered openings, are being used. A tempered glass window two feet in diameter permits underwater observation of swimmers in action. Noise reverberation will be cut by the use of acoustic material so that spoken instructions or announcements can be heard easily. The interior of the building is especially attractive through the use of face brick, yellow glazed brick, and plaster. In the pool room itself, tile of an eggplant shade blends pleasantly with the warm light gray of walls and ceiling. The tanks are of white tile. Light gray tile will cover the decks themselves, with a clear light yellow tile in copings and other accents. In the women students' quarters, a gray-green glazed brick has been used. Wherever necessary, tempered glass has been used in the glazing as a precaution against accidents. Throughout, materials have been selected with a view to economical maintenance as well as pleasant appearance. Of the $428,000 which were pledged by Alumni during the campaign to provide these facilities, $400,000 have already been received.

W. F. H. Purcell, '38

During construction: a treatment tank, part of the water system, arrives for installation.

A Day and a Decade

Alumni Day 1940 Celebrated as Marking Dr. Compton's Tenth Year; Pierre S. du Pont a Class Day Speaker; Festivities Enthusiastically Enjoyed

THE banquet which concluded Alumni Day 1940, attended by over a thousand — the largest banquet group on record — was not merely the close of a most successful and enthusiastically enjoyed festive day but celebration of the commencement of Karl T. Compton's second decade as president of the M.I.T. Alumni saluted the record and greeted the man with a demonstration of good-fellowship the extent and sincerity of which marked well the affection and loyalty with which Dr. Compton is regarded. A silver flagon presented on behalf of the Alumni Association was tangible representation of that feeling, as were roses for Mrs. Compton. A gift of $100,000 from Alfred P. Sloan, Jr., '95, to expand the present Sloan Automotive Laboratory for better co-operation in national defense through aeronautical engine research, and a grant of $200,000 from the Rockefeller Foundation to foster a program of education and research in biological engineering were announced by Dr. Compton in the course of his annual survey of Institute affairs. The cordiality of the evening found another opportunity for expression when Dr. Compton introduced Mrs. Ellen A. King, who for long years, as sustainer of the hungry in the Rogers lunchroom and then as supplier to the intellect in the Cilley Library in Walker Memorial, endeared herself to Technology men. She was roundly applauded.

The day which this banquet brought to an end was one of praise for the tireless committees and their able chief, Francis A. Barrett, '24, and of unqualified satisfaction to the hundreds of Alumni and their families and friends. The remarks of the conference speakers are substantially presented in this issue of The Review. Dedication of the Alumni Swimming Pool is also detailed elsewhere (page 380). This first portion of Technology's planned athletic center, made possible by alumni, student, and staff generosity, was open for inspection after the dedication ceremonies.

Vantine

KARL TAYLOR COMPTON
President of the M.I.T.

Class Day

Speakers at Class Day exercises included Pierre S. du Pont, representing the fifty-year class, and Louis H. Young, the twenty-five-year class. Frank B. Jewett, '03, as president of the Alumni Association, presented 1940 its class banner, with acceptance by David T. Morgenthaler, Acting President of 1940.

In the course of his remarks, Mr. du Pont declared: "Today we stand on the threshold of events the outcome of which no man can foretell. Empires looked upon as everlasting as the seas and mountains, seem to be crumbling; lesser nations have already disappeared. We ourselves have changed suddenly from a people committed to isolation and peace regardless of trends in foreign lands, and we are now embarking on a course of military, naval, and aerial defense the like of which has never before been known. Such reversed courses are by nature hysterical; they may become dangerously so without proper guidance.

"The choice of those who will guide us in the future should rest upon such as possess calm judgment for planning the course to be pursued. Ability to assemble facts, to weigh their importance, and to select for immediate attention the most necessary preparations should be possessed by the planners and exercised by them to the greatest degree. The planners' former record for correct analysis and action must be of the best. Mere spending of huge sums of money, and haphazard action without correlating the whole, end nowhere. In times of stress a good leader does not depend upon the result of experiments but uses first, and to the utmost, well-known and well-tried materials and methods. A foundation so laid may be supplemented, but supplemented only, by additions of an experimental nature. If conditions are critical, plans for economic and social reform should be laid aside temporarily, even to the point of a retrogression to old-fashioned but well-tried methods, instead of pursuit of those untried or not yet thoroughly proved successful.

"Wise leaders must have the will and desire to delegate work, must select with great care their immediate subordinates, delegate to them definitely the work to be

pursued, require full and frequent reporting, but only to such extent as is useful and necessary for measuring results and for future planning. Good delegates can be hampered, and at times their work destroyed, by too much unsought attention and direction from above.

"Single-minded judgment should be avoided. All men make mistakes; therefore, opinions of others should be sought constantly, but in the end the responsible head — be it a single individual or a group of men — must make decision clear cut, definite, and in accord with the best collective judgment.

"Organization for defense preparedness is more nearly akin to modern industrial organization than it is either to political organization or to such organization as is needed for army, navy, or air force maneuvers. The development of different industrial enterprises has brought forward a number of groups and individuals best qualified in their own lines but all possessed of a common aptitude that brings about co-operation and co-ordination in collective enterprise. . . .

"Ability to organize large operations of different kinds into a co-ordinated whole seems to be born in men and not likely to be acquired by those who have failed to show themselves possessed of it in lesser operations. Therefore, in selecting a leader to bring about rapid and orderly development of a preparedness campaign, it is of prime importance to place the responsibility upon one or more men who have already shown themselves capable of carrying the burden. Such men are to be found among the industrial or financial groups; it would be surprising to find them in the political group."

M.I.T. Photo

Technology's fleet expands — one of the new Lawley 110's on her first voyage after the christening at which Dr. Compton presided on Alumni Day.

Christening of Boats

Christening of two Lawley 110 class boats afforded Alumni a close-up of another aspect of the Institute's general athletic and recreational program. The new craft, 24 feet in length, 4 feet 2 inches in beam, carrying 118 square feet of sail, and with 300-pound keels, were purchased from the Henry Adams Morss Memorial Fund, established by the family of Mr. Morss, '93, who served the Institute long and ably as a member of the Corporation and whose interest in the sailing project was unstinting. Miss Eleanor Morss, his daughter, christened one of the new boats the *Morss*, and Mrs. William H. Prosser, daughter of Professor Erwin H. Schell, '12, active supporter of sailing at the Institute, christened the second the *Schell*. Exceptionally fast, the Lawley 110's sport genoa jibs and parachute spinnakers. The boats are painted in complementary fashion, employing the Institute colors.

President Compton's Address

Always a highlight of the Alumni Day banquet is President Compton's annual family survey of how things have been going at the Institute. It was of added interest this year since it reviewed a decade. Salient portions follow: "Just as a census is taken every ten years, so it is useful in our institutional affairs to take stock from time to time. You have honored me by making this dinner in the nature of a celebration of my ten years of service to your institution. It seems fitting, therefore, that I should respond by making a report of stewardship over this period. I do so with some pride in our progress and accomplishments and much humility in the realization of failure to accomplish more, considering the wonderful possibilities which we have had before us, many of which we have not succeeded in converting into realities. But most of all I would pay tribute to the devotion, co-operation, and ability of my colleagues, without which nothing could have been accomplished and whose teamwork is the finest quality of our institution.

"During the past ten years gifts have totaled $16,273,000, which included $5,000,000 from the balance of the George Eastman contract. This sum compares with $13,237,000 in the decade 1920 to 1930, of which $4,500,000 were from the Eastman contract. Of the funds donated in the past decade, $14,500,000 have gone into endowment and buildings, and the balance of $1,773,000 has been expended to finance current projects. The net amount of invested funds has increased from a book value of $30,000,000 in 1929 to one of $37,000,000 in 1939. Value of plant has gone from $13,883,000 to $16,000,000. About $3,225,000 have been added to permanent scholarship and relief funds.

"Notable additions to our physical plant are the George Eastman Research Laboratories for physics and chemistry, the William Barton Rogers Building for architecture and other purposes, the Wright Brothers Memorial Wind Tunnel, the Graduate House, Bexley Hall for residence of married graduate students, the Cyclotron Laboratory, the High-Voltage Laboratory, the Barbour Field House, the Briggs Field House and adjoining track and athletic field, the fine new Alumni Swimming Pool, the Solar-Radiation Laboratory, and several minor buildings. At the same time there has been notable progress in the beautification of the grounds.

"These new facilities, and attendant factors, have had a profound influence on the Institute's prestige and accomplishment. Look, (*Continued on page 386*)

THE INSTITUTE GAZETTE

PREPARED IN COLLABORATION WITH THE TECHNOLOGY NEWS SERVICE

A Message to 1940

IN his *bon voyage* message to the 691 graduates awarded degrees at the Institute's seventy-third commencement exercises on June 4, President Compton emphasized the importance of a technical education as a preparation for meeting the vexing human problems that confront this bewildered and uneasy world. He stressed his conviction that the basic objective of Technology's contribution to education is the improvement of the lot of mankind and urged the co-ordination of individual skills in co-operative efforts.

Turning to international relations, Dr. Compton spoke, as often before, of his firm faith in the idealism of the youth of America: "This is a world governed by the scientific laws which you have studied; its material resources are available for use or abuse by mankind. It is a world of people, fundamentally people like you and me, divided into groups having differing and sometimes clashing ideologies and easily swayed by emotions. One national group feels bitterness and desires revenge for previous humiliation and, in its opinion, for injustice. Another group is swayed by ambition. Another group, including most of us, wants to be left alone to work out its own salvation without interference with, or from, the outside. One side believes in the rights of minorities and in self-determination, while another side believes in merging weaker groups into a unit dominated by the strongest member.

"Our nation went to war in 1917 for a great ideal. The charge that we went for sordid motives or were led into it by financially or politically interested groups is false and absurd. The fact is that the nation was swept by a wave of idealism and self-sacrifice. We went to aid countries whose self-determination had been transgressed; we went to make the world safe for democracy; we sacrificed and fought to end war for all time. In the disillusionment of failure to accomplish these objectives, some have become cynical and have charged self-interest, propaganda, greed, and the like to the generation of 1917. This tendency is peculiarly strong among the youth of today, who, like their elders, recognize the failure but who do not understand what happened. Make no mistake about it, our people overwhelmingly went into that war in 1917 with high and worthy ideals, and it was not then or in 1918 that we failed.

"Those ideals are just as true today as they were then. They just as much deserve protection. Our great job today is not to lose faith in the ideals but to try to avoid the mistakes made subsequent to 1917 — mistakes which lost us the opportunity that was in our grasp to secure democracy and peace.

"It seems clear to me that these mistakes were principally three: First, though we and our allies made great sacrifices to win the war, we were too selfish to make sacrifices to reduce bases for future wars. Second (and here we in America are especially at fault), having co-operated to secure victory, we were unwilling to shoulder the responsibility of sharing the administration of peace. Third, having gone through the shock of the last war and having had our hopes of universal peace raised, we refused to heed the clear danger signals of oncoming catastrophe and to take vigorous steps to prevent it. I think there is no doubt that it could have been prevented had the nonaggressor nations, including ourselves, had the wisdom, courage, and social responsibility to say to an aggressor quickly, in no uncertain terms, backing their threat with adequate force: 'You shall not invade another's territory, else the economic and military forces of the peace-loving world are put in action against you.'

"I believe that the policies of pacifism and isolationism, whether caused by idealism or by selfishness, are in no small degree responsible for today's tragic ruin of the hopes of twenty years ago. I feel sure that many sincere people do not agree with this diagnosis. An essential part of our democratic heritage is that we can disagree and debate. After thorough discussion the preponderant judgment of the mass of intelligent people is more likely to be wise in the long run than is the judgment of any individual or small group. When this mass judgment is pronounced, it is part of the democratic process to co-operate in the

Professor Ralph G. Hudson, '07, with (left to right) Marshall P. Bearce, Henry Rapoport, and Thomas F. Creamer, marshals of the Class of 1940, checking plans for Commencement Day

fulfillment of this judgment. But the question of whether you agree with me or not is perhaps not so significant. What is significant is that you are entering a world in which tremendous problems must be met and solved. You should have in you the realism of the engineer and the logic of the scientist. These are valuable qualities with which to face such problems. Add to these the idealism of American youth at its best, and I have faith in the results."

To the Corporation

JAMES M. BARKER, '07, a member of the board of directors of Sears, Roebuck and Company and former Vice-President and Treasurer of that company, was elected a life member of the Institute's governing body at its meeting on June 4. He served as an alumni term member of the Corporation from 1934 to 1939.

Following his graduation, Dr. Barker was an assistant in Civil Engineering for two years, after which he joined the American Bridge Company as a draftsman. Later he carried on special engineering work for Professor George F. Swain, '77. Returning to the Institute in 1914, he was a member of the teaching staff of the Department of Civil Engineering until 1919. During this period he was also an instructor in civil engineering in the Graduate School of Applied Science at Harvard University from 1914 to 1915. Dr. Barker joined the First National Bank of Boston in 1919, and from 1920 to 1928 he was manager of its branch in Buenos Aires.

His association with Sears, Roebuck began in 1928 in Philadelphia, whence he moved to the company's headquarters in Chicago. His election as vice-president came in 1930. Dr. Barker is a director of the Harris Trust and Savings Bank of Chicago and a member of the American Society of Civil Engineers, the University clubs of Chicago and New York, the Algonquin Club of Boston, and the Jockey Club of Buenos Aires.

New Department

AS part of its broadening attack on problems of the building industry, the Institute has established a Department of Building Engineering and Construction. The program of the new Department will be based on the work of the Institute's long-established Course in Building Engineering and Construction, which has been part of the Department of Civil and Sanitary Engineering. Professor Walter C. Voss, '32, who has been in charge of the Course, has been appointed head of the new Department. Associated with him on the staff will be Dean Peabody, Jr., '10, Associate Professor of Structural Design; Howard R. Staley, '35, Assistant Professor of Building Construction; and Albert G. Dietz, '32, instructor in Building Engineering and Construction.

The program of the new Department, as explained by Professor Voss, is designed to meet the requirements of the building industry, which is acutely in need of technically trained leaders who will apply themselves to the solution of problems created by outworn traditions, inefficient methods, and lack of vision. Professional training for building engineering requires not only technical

To the Corporation: James M. Barker, '07

knowledge but an intelligent understanding of the pattern of national life and the far-reaching social implications of housing.

"To meet the challenge which the integration of this vast industry presents," Professor Voss said, "the Institute's new Department has as its objective the training of men in subjects basic to the engineering design and construction of buildings. These include the more economical and intelligent use of existing materials; studies of matters fundamental to the development of new materials and methods; and the economic factors which control the industry's operations. The Department will strive to develop in the student an appreciation of the related problems of the architect, engineer, builder, and manufacturer."

Visiting Committee Report

DEPARTMENT OF MODERN LANGUAGES *

THE Committee discussed at length the position that modern languages are intended to occupy in the curricula of the Institute and unanimously expressed their opinion of the desirability of having an applicant for admission to the Institute trained in the study of at least one foreign language. The Committee believe that this is one of the most effective ways of carrying out the spirit of the following statement in the Institute catalogue pertaining to a candidate for admission:

* Members of this Committee for 1939–1940 are H. B. Richmond, '14, Chairman, Arthur T. Hopkins, '97, Donald G. Robbins, '07, William H. Coburn, '11, John E. Aldred, Albert L. Guérard, and Taylor Starck.

"The candidate should bear in mind that the broader his intellectual training and the more extensive his general attainments, the greater will be the advantages he may expect to gain."

Dean Caldwell expressed to the Committee his complete sympathy with this desire on the part of the Committee but explained the difficulty of its accomplishment at the present time when, particularly in some of the midwestern sections of the country, no language preparation has been given to otherwise excellent applicants. The Committee accordingly felt that it would be unwise at this time to change the entrance requirements in regard to modern languages. They felt, however, that emphasis should be placed on the desirability of special preparation and that although actual instruction in a modern language is desirable before entrance to the Institute, the policy of several of the Departments — for example, that of Mechanical Engineering — should at least be extended as a minimum requirement in all Courses. This requirement is that for admission to work in the senior year or recommendation for a degree, the student must have a reading knowledge of French or German. The Committee would widen the choice of languages, however, so as to include a reading knowledge of any modern language in addition to English, but with the hope that the list should ultimately coincide with those languages in which entrance credits are allowed, namely, French, German, Spanish, and Italian.

Library Expansion

THE Cilley Library in Walker Memorial, much used by students and staff for relaxation, is to be enlarged this summer. The library has been located in a room in the southeast corner of the second floor of Walker Memorial and has gradually spread to an adjoining gallery. With the purchase of new books, shelf space in the present quarters has been exhausted. Acting on the recommendation of the Faculty Committee on the Library, the Executive Committee of the Corporation has made an appropriation to transfer the library to the opposite side of the building and to increase the amount of space devoted to books. By the addition of the present faculty dining room, the need for which has been relieved by the restaurant facilities in the new Graduate House, the Cilley Library will have room for nearly double its present 12,000 volumes, and its growth for the next few years will be anticipated. Its new facilities, which will include a satisfactory reading space, are expected to be of special assistance to students pursuing courses in the humanities under the Department of English and History. Half the present faculty dining room will be devoted to books and the remainder to a comfortable reading room, somewhat more secluded and convenient than any other space now available in the building. Not only will the present usefulness of the library be continued but, it is hoped, additional purchases of books for more serious reading may be made under the Frank H. Cilley Fund. The present faculty lounge, which is used chiefly for a music room for students, will be transferred to the old library quarters.

Annual Meeting

PRESENTATION of new officers of the Alumni Association and of regular annual reports engaged the Alumni Council at its 214th meeting on the last Monday in May, which concluded the year's work. Raymond Stevens, '17, retiring Vice-President, was chairman in the absence of Frank B. Jewett, '03. Technology's share in present programs for national defense was described by President Compton.

Tenney L. Davis, '13, Professor of Organic Chemistry, gave a brief talk on modern explosives, illustrated by demonstration experiments; and Stephen G. Simpson, '16, Assistant Professor of Chemistry, noted for his practice of prestidigitation, presented a series of tricks of magic which were regarded as a fitting conclusion to the year's activities.

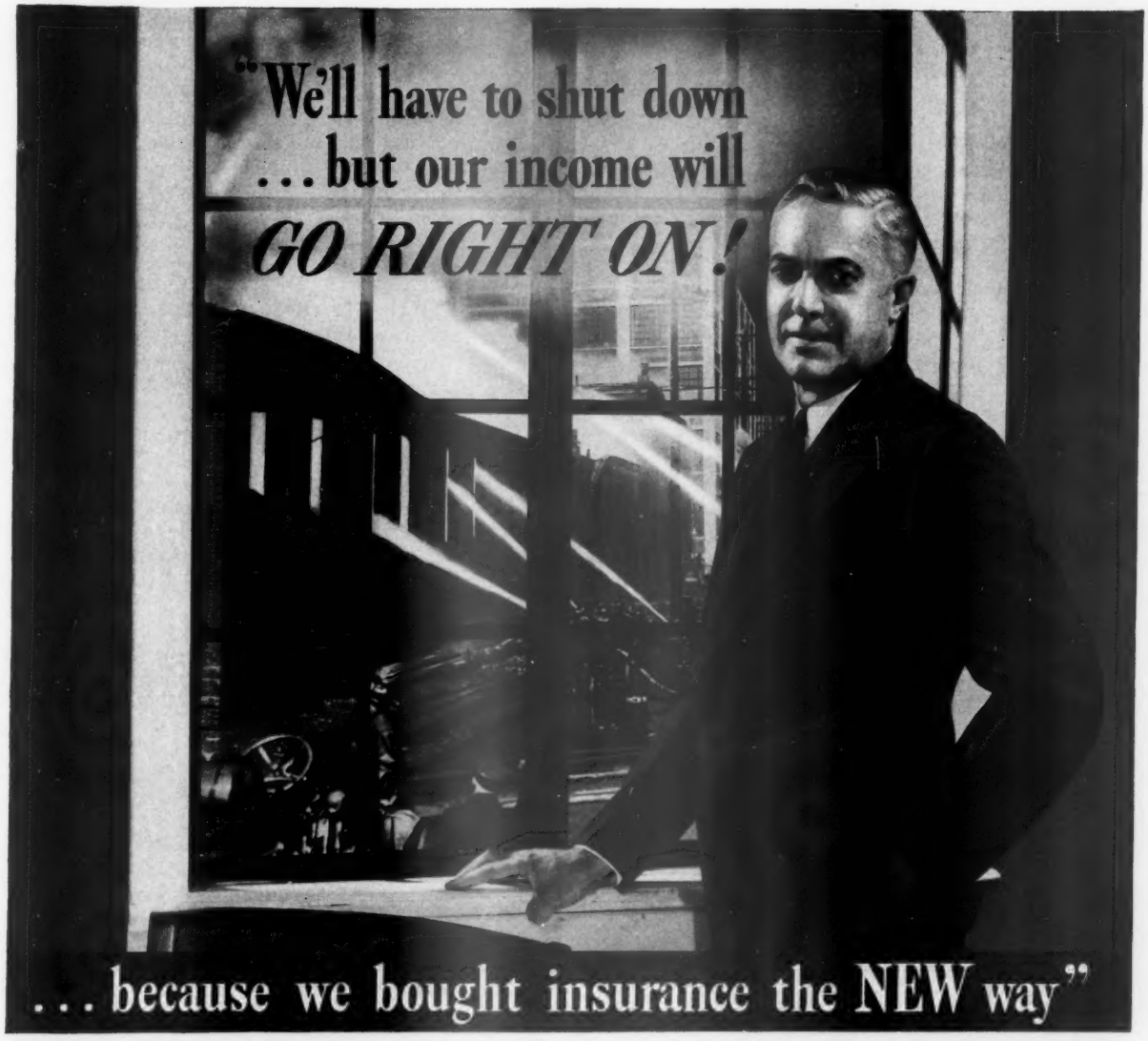
A DAY AND A DECADE

(*Continued from page 383*)

for just one example, at the annual reports of research accomplishment as given in papers read at meetings of the American Physical Society. In the year 1929–1930 two such papers came from M.I.T.; from February, 1939, through April, 1940, there were sixty-three — between two and three times as many as came from any other educational institution or industrial or governmental organization. Four hundred and twenty-five books, papers, and other publications issued from the staff in 1939 as compared with 259 in 1930. At the last three general meetings of the American Chemical Society, more papers were presented from M.I.T. than from any other educational institution. . . .

"Probably the most important development of policy has been one which has, so faculty and employment officers testify, notably improved the quality of our students through wider choice and more careful selection of applicants for admission. Incidentally it has changed the distribution of our student body from 65 per cent from Massachusetts ten years ago to 65 per cent from outside Massachusetts this year. This change has been accomplished by a combination of factors: greater flexibility without lowering standards of entrance requirements, stabilization of enrollment at a predetermined figure, establishment of regional and freshman competitive scholarships, and especially the able and devoted help of about 200 Honorary Secretaries, located in every important population center, who interview and report on each candidate for admission. Recently we have been admitting about one out of three applicants; eight to ten years ago, before the stabilization plan was adopted, we were worried over falling enrollment!

"Of greater ultimate significance than any of our new developments may be the recently established M.I.T. Alumni Fund, which broadens the base of support of the Institute through annual contributions by Alumni. Instead of a high-pressure campaign for funds every twenty years or so, this plan will operate on a calm and friendly basis, permitting every Alumnus to include the Institute, as generously as he may wish, among his annual charities. . . . (*Concluded on page 388*)



"Of course we always have carried plenty of insurance on our buildings and contents, but it took a smart insurance man to show me that I could lose more as a result of a shut-down than the plant itself was worth.

"He pointed out that I also needed insurance to cover fixed charges, wages and salaries of key men, advertising and other expenses that would continue during the shut-down from fire, windstorm, explosion, riot, aircraft and several other kinds of destruction.

"Then he told me about Business Interruption Insurance, putting clear-cut information of the NEW way to buy insurance into a complete survey that he made especially for us. We bought the protection and now, after the fire, our usual dividends can be paid, our organization held together, ready when we reopen. We are sitting pretty."

It will pay you to buy Insurance the NEW *way*

The NEW way of buying insurance is based on the idea that it hurts just as much to lose a dollar one way as another and that *what hurts most are the big losses.* Hartford agents sell insurance, not just policies. They know how to fit insurance to your particular requirements—whatever they may be.

Just call Western Union

—in Canada, call Canadian National Telegraphs—and ask for the name of the nearest Hartford representative. Or call your own insurance broker for full details on Business Interruption Insurance and the NEW way of buying insurance protection for yourself.

Hartford Fire Insurance Company

and the HARTFORD ACCIDENT AND INDEMNITY COMPANY write practically every form of insurance except life

HARTFORD, CONNECTICUT

A DAY AND A DECADE

(*Concluded from page 386*)

"The Institute again closes its year's operations, and its all-time record of operations, without a deficit. Our budgetary control has been very close and our Finance Committee's handling of investments very successful, considering the times. During the year $670,600 have been received in gifts and bequests. While this amount is substantially less than that of the two preceding years, it is nevertheless significant. Notable in this year's list are $50,000 from the Charles Hayden Foundation for scholarships, $98,261 additional to the Thomas Upham Fund for student aid, $34,750 from the Alfred P. Sloan Foundation for postgraduate fellowships in Business Administration, $35,550 contributed from many industrial companies toward support of our Industrial Relations Section, $30,000 anonymously donated for research in cosmic-terrestrial relations, $10,000 from Bartlett Arkell in support of our food technology program, $27,210 in final payments of pledges in the recent Gymnasium Fund campaign, and numerous other items. The Class of 1923 has very generously and in timely fashion voted a special gift of $10,000 to provide the garden and the wall in front of the Alumni Swimming Pool, thus adding a very attractive and useful feature which otherwise would have had to be omitted because of lack of funds.

"I am particularly glad to announce that the Rockefeller Foundation, after careful consideration, has come to our assistance in the biological engineering program with a grant of $200,000 to be used, over a period of not less than five nor more than seven years, to help us get this program started and given a period of trial development. In this connection I can also announce the following additions to the staff of biological engineering, which is a division of our Department of Biology and Public Health: Professor E. Newton Harvey, physiologist, biochemist, and biophysicist of Princeton University, will spend a part of his time at M.I.T. next year as a lecturer and consultant and will direct one or two research projects. John R. Loofbourow, formerly of the staff of the basic science research laboratory of the University of Cincinnati and now research professor at the Institutum Divi Thomae, will join our staff next fall as associate professor of biophysics. He has a distinguished record as teacher, administrator, and investigator. Another new and interesting appointment is that of Ernest E. Lockhart, '34, now physiologist and biochemist at West Base, Antarctica, who rejoins the Department as research associate. Taking part in the teaching of advanced subjects, these new men will supplement the present excellent staff in biology and public health. . . .

"You must naturally wonder what the Institute is doing about national defense. Briefly stated, we are helping where we can and are making efforts to put ourselves in condition to be useful along certain lines to which our facilities of equipment and staff are peculiarly adapted. With war become so highly technical and mechanized, our contribution can be more significant than ever before — in the training of technicians, in the selection of men for important technical or administrative posts, and in the conduct of research and development projects. I cannot properly give details, but I can say that several of our staff have been loaned temporarily to the government, that various ones of us are in consultation every day on the preparedness program, and that provision has been made to prosecute several research-development projects of importance.

"One thing I can announce, however, and I do so with the greatest satisfaction. You all know that M.I.T. established the first courses in, and the first department of, aeronautical engineering in America and that the record of our research and the performance of our graduates in this field have been very significant. . . . This aeronautical engineering work has two main aspects: the design of planes and the design of aircraft engines. In the fall of 1938 we dedicated the Wright Brothers Memorial Wind Tunnel, the gift of men interested in the progress of aviation. Subsequent use has demonstrated that this wind tunnel is equal to the best in the world in its accuracy and usefulness for developing the aerodynamical features of airplanes. It is now in constant use by day and in frequent use by night. On the power-plant side we have had the Sloan Automotive Laboratory, given us by Alfred P. Sloan, Jr., in 1929, and largely equipped through the generosity of Henry M. Crane, '95. It is excellently adapted to engine testing and research and serves the needs both of ordinary automotive engineering and of aviation power-plant engineering, though the principal emphasis has been on the latter.

"For several years past it has become increasingly evident that the growing aviation industry calls for more students trained in this field. The present great program of national preparedness further emphasizes this want. Although we realized this need and opportunity, we could not meet them because our facilities and space were already being used to capacity. The particular bottleneck for us was the overcrowding of the automotive engine laboratory. A few days ago, I was called by long-distance telephone by a gentleman who had learned of this situation. He wanted to help us to increase the effectiveness of our contribution to the nation's program of aircraft design and production. He asked some very pertinent questions, including: 'How much will you need to expand the automotive laboratory so as to take care of the airplane engine work satisfactorily?' I told him that we would need $100,000, and that this sum would be used to erect a two-story addition to the present engine laboratory. He then said: 'You can count on me for that; go ahead with it.'

"This friend who so opportunely stepped in to enable us to expand our program in aeronautical engineering at a time when the need is so urgent is the same benefactor who, eleven years ago, gave us our present automotive laboratory — Alfred P. Sloan, Jr., of the Class of 1895.

". . . The past ten years have been the most interesting and satisfying years of my life. I owe an enormous debt of gratitude for the privilege of serving this great institution and for your unfailing friendship and cooperation. I wish I could have accomplished more, and I pledge you my best efforts in the years that are ahead."

This Man Created *MARKETS*

WOULD the electrician have his job? Would you and I have electricity as a utility? Would we have radios or motion pictures? Or could we enjoy life as we do had not Edison labored as he did? Tirelessly, he sought answers to riddles. With the answers known to him, he applied what he had learned to indefatigable research so that we might enjoy the safety and the comfort of the many utilities made possible by the harnessing of that great force of Nature, Electricity.

Yes, the electrician might have his job today because some other man or some other men might have done just what Edison did—but the point remains that Edison did these things when he did them and made them practical and available within a few short years after he had uncovered the secrets.

Sixty years ago, his phonograph made possible the recording and the reproduction of the sound of the human voice. A decade afterward, because Edison wanted to give action in pictures to the sounds he could record and reproduce with his phonograph, he made his motion picture camera and projector and subsequently invented the talking motion picture.

Yes, the motion picture industry might exist had not Edison done these things, but his contribution to this art is recognized and honored by that great industry itself.

Other men might have done what Edison did, but the point remains that Edison did these things when he did them and he made them available for mankind to enjoy.

Waxed paper and gummed paper tape—perhaps you do not know that Thomas A. Edison was the first to make these. Humble utilities they may be, but nevertheless they play an important part in our every day life and it was Edison who brought them into use for our benefit. Over 1100 different patents were awarded him during his lifetime.

By doing all of the things he did, Thomas A. Edison created many great markets. He established the need for mass employment. He made our world a safer, a better and a more pleasant place in which to live.

Insistence on quality and thoroughness which characterized the work in his research laboratories and in his factories guides the Thomas A. Edison Industries today. Thinking is still on a 24 hour shift in the Edison Laboratories and in the factories, thousands of pairs of hands continue their work for the benefit of mankind.

AMONG THE PRODUCTS OF THE THOMAS A. EDISON INDUSTRIES ARE EDIPHONES . . . *FOR DICTATION,* STORAGE AND PRIMARY BATTERIES, SPARK PLUGS, MAGNETOS, IGNITION COILS, GENERATORS, ELECTRICAL CONTROLS, CEMENT, MEDICAL GASES, NURSERY FURNITURE AND MANY OTHER SMALL AND LARGE MANUFACTURED ITEMS FOR INDUSTRY.

Thomas A Edison *INCORPORATED* • WEST ORANGE • NEW JERSEY

NEWS BY ELECTRIC WAVES

(*Concluded from page 378*)

PARKER, R. D. "Telephone Typewriters and Auxiliary Arrangements," *Bell Telephone Quarterly*, 8:181–194 (July, 1929).

WATSON, E. F. "Fundamentals of Teletypewriters Used in the Bell System," *Bell System Technical Journal*, 17:620–639 (October, 1938).

TELETYPESETTER

COOK, L. R., and M. T. GOETZ. "Setting Type by Wire — The Teletypesetter," *Journal of the Western Society of Engineers*, 43:71–83 (April, 1938).

III. RADIO-WAVE TRANSMISSION

RADIO COMMUNICATION — THE GENERAL SUBJECT

ARCHER, GLEASON L. *History of Radio to 1926*. New York: American Historical Society, Inc., 1938. Pp. vi+421. $4.00.

———. *Big Business and Radio*. New York: American Historical Society, Inc., 1939. Pp. vi+503. $4.00.

DUNLAP, ORRIN E., JR. *Marconi, the Man and His Wireless*. New York: The Macmillan Company, 1937. Pp. xxi+360. $3.50.

INSTITUTE OF RADIO ENGINEERS, Annual Review Committee. "Radio Progress." Prepared by Institute of Radio Engineers technical committees and published annually in the *Proceedings* of the institute. Each report includes summary and bibliography.

BROADCASTING

"Radio I: A $140,000,000 Art"; "II: A $45,000,000 Talent Bill"; "III: A $537,000,000 Set Business," *Fortune*, 17:47 (May, 1938).

RAHMEL, H. A., '33, and C. H. WARRINER. "Circuits for Politics," *Electronics*, 9:12 (September, 1936).

Principles and Practices of Network Radio Broadcasting. New York: RCA Institutes Technical Press, 1939.
Testimony of David Sarnoff before the Federal Communications Commission, November 14, 1938, to May 17, 1939.

FREQUENCY MODULATION

ARMSTRONG, EDWIN H. "A Method of Reducing Disturbances in Radio Signaling by a System of Frequency Modulation," *Proceedings of the Institute of Radio Engineers*, 24:689–740 (May, 1936).

"FM Gets Its 'Day in Court,'" *Electronics*, 13:14 (April, 1940).

"Frequency Modulation — a Revolution in Broadcasting?" *Electronics*, 13:10 (January, 1940).

"Frequency Modulation Demonstrated . . . ," *Electronics*, 12:14 (March, 1939).
A description of Major Armstrong's station at Alpine, N. J.

"Revolution in Radio," *Fortune*, 20:86 (October, 1939).

WEIR, I. R. "Field Tests of Frequency- and Amplitude-Modulation with Ultrahigh-Frequency Waves," Part I, *General Electric Review*, 42:188–191 (May, 1939); Part II, *ibid.*, 270–273 (June, 1939).

RADIOTELEPHONY

ANDERSON, C. N., and I. E. LATTIMER. "Operation of a Ship-Shore Radiotelephone System," *Proceedings of the Institute of Radio Engineers*, 20:407–433 (March, 1932).

BOWN, RALPH. "Transoceanic Radiotelephone Development," *Proceedings of the Institute of Radio Engineers*, 25:1124–1135 (September, 1937).

DUDLEY, BEVERLY, '35. "Radiophone Service for Small Ships," *Electronics*, 12:11 (March, 1939).

ESPENSCHIED, LLOYD. "The Origin and Development of Radiotelephony," *Proceedings of the Institute of Radio Engineers*," 25: 1101–1123 (September, 1937).

RADIO AIDS IN NAVIGATION

BOWLES, EDWARD L., '22, and OTHERS. "The CAA-MIT Microwave Instrument Landing System," American Institute of Electrical Engineers Technical Paper 40–44 (January, 1940).

GREGG, WILLIS RAY. "Progress in Weather Forecasting," *Electrical Engineering*, 57:405–412 (October, 1938).

JACKSON, W. E. "Status of Instrument Landing Systems," *Proceedings of the Institute of Radio Engineers*, 26:681–699 (June, 1938).

MORGAN, HOWARD K. *Aircraft Radio and Electrical Equipment*. New York: Pitman Publishing Corporation, 1939. Pp. ix+374. $4.50.

TUSKA, C. D. "Radio in Navigation," *Journal of the Franklin Institute*, 228:433–443 (October, 1939); *ibid.*, 581–603 (November, 1939).

UNITED STATES BUREAU OF AIR COMMERCE, Aeronautics Bulletin Number 27 (1937). "Aeronautic Radio."

POLICE COMMUNICATION

LEONARD, V. A. *Police Communication Systems*. Berkeley: University of California Press, 1938. Pp. xvi+589. $5.00.

WHITE, EDWIN LEE, and E. C. DENSTAEDT. "Police Radio Communication," *Electrical Engineering*, 56:532–544 (May, 1937).

TELEVISION

CASTLE, DONALD H. "A Television Demonstration System for the New York World's Fair," *RCA Review*, 4:6–13 (July, 1939).

FINK, DONALD G., '33. *Principles of Television Engineering*. New York: McGraw-Hill Book Company, Inc., 1940. Pp. xii+541. $5.00.

FISKE, IRVING. "Where Does Television Belong?" *Harper's Magazine*, 180:265–269 (February, 1940).

KERSTA, NORAN E., '36. "The Business Side of Television," *Electronics*, 13:10 (March, 1940).

Television: Collected Addresses and Papers on the Future of the New Art and Its Recent Technical Developments (two volumes). New York: RCA Institutes Technical Press, 1936–1937.
Collected papers written by R.C.A. staff members.

"Television in the Field," *Electronics*, 12:12 (June, 1939).
Public television service in New York City.

WALDROP, FRANK C., and JOSEPH BORKIN. *Television: a Struggle for Power*. New York: William Morrow and Company, 1938. Pp. xii+299. $2.75.

ZWORYKIN, V. K., and G. A. MORTON, '26. *Television: the Electronics of Image Transmission*. New York: John Wiley & Sons, Inc., 1940. Pp. xi+646. $6.00.

The compiler wishes to thank Carlton E. Tucker, '18, Professor of Electrical Engineering, and Wilmer L. Barrow, '29, Assistant Professor of Electrical Communications, for their aid in planning the material included in this list. Copies of this and the preceding nine in the series may be obtained from the Institute Librarian.

WANTED

1. **TESTING ENGINEER** with engine testing experience. Unusually good opportunity. Responsible position.
2. **PROJECT ENGINEER** with good engine design experience.
3. **DRAFTSMEN** with good drafting room experience.

Must be American citizens. Government work involved. M.I.T. men preferred. Reply to Box A, The Technology Review, Cambridge, Mass.

ESTABLISHED 1818

Brooks Brothers

CLOTHING,

Men's Furnishings, Hats & Shoes

MADISON AVENUE COR. FORTY-FOURTH STREET
NEW YORK

FINE WOOLLENS . . . VINTAGE
WINES . . . RARE TOBACCOS

Picking out good materials for clothes is like selecting vintage wines or fine tobaccos. There is a list of generic names like "Flannel," "Tweed," "Worsted" — just as there are "Bordeaux," "Burgundy," and "Havana." To pick the best grades and qualities from the lines of the best producers requires skill and experience . . . and Brooks Brothers' standards are famous in ready-made clothes.

Ready-made Suits $62 to $85

Suits for College Undergraduates, Upper-Formers and Younger Business Men, $42 to $50

BRANCHES
NEW YORK: ONE WALL STREET
BOSTON: NEWBURY COR. BERKELEY STREET

© Brooks Brothers

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Cambridge, Massachusetts

THE schools of Architecture, Engineering and Science, the Graduate School and the Division of Humanities offer instruction and opportunities for research, both undergraduate and graduate, in the following fields of study as well as in allied subjects:

SCHOOL OF ARCHITECTURE
Architecture
City Planning
City Planning Practice

SCHOOL OF SCIENCE
Biology and Public Health
Chemistry
General Science
Geology
Mathematics
Physics

SCHOOL OF ENGINEERING
Aeronautical Engineering
Building Engineering and Construction
Business and Engineering Administration
Chemical Engineering
Civil and Sanitary Engineering
Electrical Engineering
General Engineering
Marine Transportation
Mechanical Engineering
Metallurgy
Naval Architecture and Marine Engineering

The Catalogue contains full information and will be sent gratis and post free upon request. All correspondence regarding admission either to undergraduate or graduate study should be addressed to the Director of Admissions, M.I.T., Cambridge, Mass.

THE
BATH IRON WORKS
CORPORATION
BATH, MAINE

Shipbuilders and Engineers

Naval Vessels
Now Under Construction

U.S.S. Gleaves — Destroyer 423
U.S.S. Niblack — Destroyer 424
U.S.S. Livermore — Destroyer 429
U.S.S. Eberle — Destroyer 430
U.S.S. Woolsey — Destroyer 437
U.S.S. Ludlow — Destroyer 438

F. W. LORD '93 T. P. CURTIS '94

LORD ELECTRIC COMPANY, INC.
ESTABLISHED 1895

ELECTRICAL CONTRACTORS
FOR
M.I.T. SWIMMING POOL

BOSTON NEW YORK PITTSBURGH

THE ENDURING FREE SOCIETY

(*Continued from page 369*)

follow the course of the evolution of communism in Russia, and see if you do not feel that it is worth while to attempt to keep the structure of American society fluid. Need we turn to right or left? Is there not a middle road by which free institutions will survive even in these perilous times?

How do we proceed down this middle road? you may ask. To my mind, the first requirement is a recognition of the validity and vitality of the American tradition of a casteless nation. We must decide what constitutes the American way of life. Today such noble words as "democracy" and "liberty" must be counted as mangled victims of this turbulent decade. The word democracy has been so debased by our friends the Communists, in their efforts to hold a popular front, that most people are wary of it. On the other hand, some of our friends in the Liberty League seem to have ruined the word liberty, at least for all who are loath to equate America with extreme conservatism or the perpetuation of a ruling caste. Our real problem is to evolve a satisfying picture of American society to which we may pledge our faith. And this picture must, I believe, portray a nation in essence still pioneering — a land both free and democratic. I suggest that every new development in politics or economics be tested by these simple questions: Does the proposal make for a more or a less highly stratified society? Does it lessen or increase the fluidity of our social structure? Does it give more promise or less promise of greater opportunity for our able youth?

I can sum up my argument in a few words: The American way of life has been unique; it is founded not so much on our political or economic institutions as on the mobility of our society — the relative absence of a ruling class. The unique features of this country have been particularly favorable for the development of a business civilization, with its attendant philosophy of liberalism. If we are to preserve this civilization, we must endeavor in every way to prevent either the establishment of a permanent ruling caste — a plutocracy — on the one hand; or, on the other, a regimented collectivistic state.

As I have already said, you, as engineers, will be working at the interface between science and society. You will be in a special position to understand the significant interrelation of industry, science, and our social system. You will recognize in every walk of life the extreme importance of the pioneer — the exceptional man who can turn the unexpected corner. You will value the political and economic freedom which gives such men the maximum chance to succeed or fail. All of you in your own lives will be participating directly in building the America of the future. Trained scientists, your skills will perhaps count more than those of many other men. I wish for you, even more than the flowering of your special talents, faith and courage in the days to come — faith in the civilization you gladly labor to pass on to later times; courage to believe in the future of that type of society, (*Concluded on page 394*)

Sinclair Refining Company, (INC.)

Refiners of PETROLEUM

•

LUBRICATING OILS

•

FUEL OILS

•

GASOLINES

Home Office: 630 Fifth Avenue, New York

Among the M.I.T. Alumni in the Sinclair Organization are:

FRED C. RANDALL . . .	'02	WILLIAM W. JOHNSON .	'23
EDWARD T. ALMY . . .	'09	R. BARLOW SMITH . . .	'33
GEORGE R. LORD	'10	JOHN E. BELL	'36
GEORGE H. TABER, JR. .	'13	PHILIP E. SELLERS . . .	'38

THE ENDURING FREE SOCIETY

(*Concluded from page 392*)

that way of life, to which you can give your deepest loyalty. Once you have a clear-cut picture in your mind of what you desire for this nation, once you have courage to believe in your own vision, then your personal problems will fall into their proper place. You can rejoice that you have lived to forward a new experiment in the history of the human race.

TECHNICAL MEN IN A REPUBLIC

(*Continued from page 371*)

the course is set, this ingenious device, as you know, keeps the ship straight on its course, regardless of wind, wave, or current. It carries in its mechanical brain a highly developed sense of responsibility, another earmark of a really well-trained technical mind. As Phillips Brooks remarked years ago: "No man has come to true greatness who has not felt in some degree that his life belongs to his race and that what God gives him He gives him for mankind." Never in our country's history has a sense of personal responsibility toward economic and public questions been so imperatively needed as today. Obviously no system of government or economics can rise higher than the collective intelligence and character of the individual citizens who compose it. Representative democracy is the hardest kind of government to operate, but to strong men who are willing to pay the price in personal effort, it yields the rich spiritual values of personal freedom.

For several generations now, the vast majority of American businessmen and professional men have completely neglected the study of the political and spiritual principles on which our political, economic, and civil liberties rest. We have smugly assumed that our American system was safe and secure, and that we could enjoy the blessings of personal freedom without assuming, as individual citizens, any responsibilities for its continued maintenance. The events of the past ten years have rudely dispelled that fatuous notion, and today millions of otherwise intelligent Americans are floundering — puzzled and disheartened — trying to live without a political and economic philosophy. To do so successfully is impossible.

As a great industrial nation, we have long been accustomed to plan ahead; hence national economic planning has something about it that appeals to almost everyone at first blush. It really rests, however, on a series of delusions. Our national economic planners are, in fact, the modern prototypes of the medicine men of our barbaric ancestors. These economic planners actually believe that modern science, if only placed at the behest of all-powerful government, can make the springs of plenty flow for everyone, with little work and sacrifice on anybody's part. They believe that somewhere there actually exist individuals who have the capacity to plan the economic affairs of the whole nation so as to insure a constantly rising standard of living. In reality, there are not enough information and ability available today to correlate the activities of any single industry to accomplish that (*Concluded on page 396*)

A SIGN OF GOOD PETROLEUM PRODUCTS

IN 38 states and Canada the Cities Service sign is the motorist's guarantee of quality petroleum products . . . for behind this emblem stands a completely integrated unit in the oil industry, enjoying the benefit of many years of practical petroleum experience. Through integration of oil wells, pipe-lines, refineries, transportation, research and marketing facilities, Cities Service Oil Companies make quality petroleum products and are able to protect these products from oil well to customer.

In the industrial oil field, Cities Service long has excelled in quality of products and service to customers.

TUNE IN! CITIES SERVICE CONCERTS EVERY FRIDAY EVENING AT 8 O'CLOCK, E.D.T.
(N. B. C. Red Network)

CITIES SERVICE OILS & GASOLENES

DAHLSTROM *Metal*

SWING DOORS, TRIM and PARTITIONS serve M.I.T. in its new SWIMMING POOL

DAHLSTROM Hollow Metal Products Include

Elevator Entrances, Swing Doors and Trim custom built to architect's specifications and in standard designs.

Insulated Metal Walls and Partitions.

Metal Mouldings for Architectural Trim, Body and Cabinet Trim, Desk and Counter Top Bindings, etc.

Custom built Metal Specialties, Fine Cabinet Housings, Metal Stampings and Special Formed Shapes from Mouldings.

Representatives in Principal Cities

H. A. SEELEY CO.
38 Chauncy St.
Boston, Mass.
District Representative
Hollow Metal Contract Division

FRED T. HARVEY
21 Pilgrim Road
Waban, Mass.
District Representative
Metal Specialties Division

DAHLSTROM METALLIC DOOR CO.
Paul N. Anderson '21 *President-General Manager*
JAMESTOWN ▪ ▪ ▪ NEW YORK

PANEL HEATING

A system of true radiant heating — circulating warm water through pipe coils embodied in building construction — thus using interior building surfaces as the source of radiant heat.

First introduced in this country in 1928, *Panel Heating* has been used extensively throughout Great Britain and the Continent since 1909.

In addition to the *Panel Heating* installation in the Swimming Pool, Massachusetts Institute of Technology, *Panel Heating* has also been installed in the following buildings:

British Embassy, Washington, D. C.
W. G. Loew Residence, New York, N. Y.
Col. H. H. Rogers Residence, Southampton, L. I.
Metropolitan State Hospital, Waltham, Mass.
James Lawrence Residence, Brookline, Mass.
Pierre S. duPont III Residence, Rockland, Del.
High School and Civic Auditorium, Everett, Wash.
Specialized Service Co., Klamath Falls, Ore.
Ralph Pomerance Residence, Cos Cob, Conn.
Paul Voigt Residence, Jeffersonville, Ind.

INSTALLED IN THE UNITED STATES UNDER SUPERVISION AND DIRECTION OF

WOLFF AND MUNIER
INCORPORATED
222 East 41st Street New York, N. Y.

United States Licensees of PANEL HEATING *for Richard Crittall and Co., Ltd., London*

TECHNICAL MEN IN A REPUBLIC

(*Concluded from page 394*)

objective, let alone correlate the infinitely complex interests of the entire country. The stagnation and loss of impetus which would result from the dilution of personal responsibility and initiative under such a system would be appalling. Furthermore, if the government once started to plan the affairs of our basic industries, the process would inevitably have to be extended to every phase of our economic life. There would be no stopping. As Stalin said in 1934: "Without getting rid of capitalism and abandoning the system of private ownership of the means of production, you cannot create planned economy."

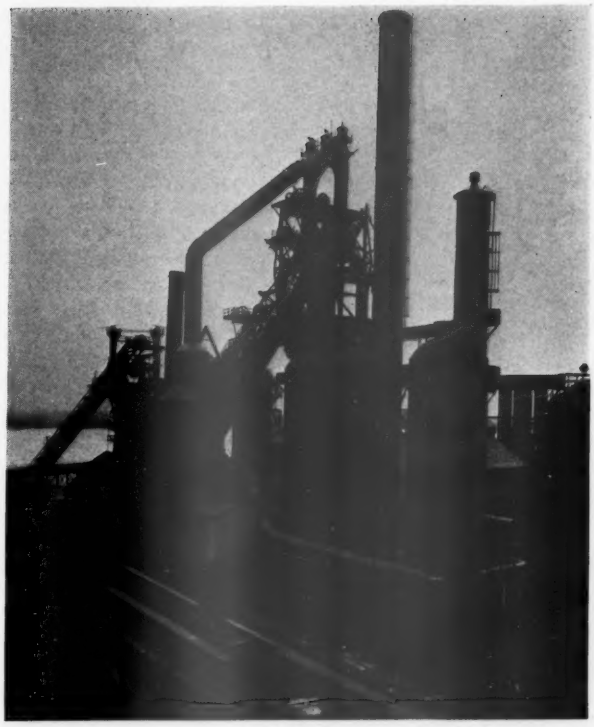
Make no mistake about this, moreover: If a group of men — no better, no worse than the rest of us — calling themselves government, began to plan the economic affairs of this nation, presumably for the greatest good of the greatest number, they could not permit any citizen, no matter how well trained technically or how well intentioned he might be, to throw monkey wrenches into their carefully laid programs. Hence government, in order to make its economic planning effective, would inevitably have to control all agencies that form public opinion — the newspaper, radio, school, and church. In common with many of you, I have personally seen that process at work in Germany, Italy, and Russia. We want none of it in America. Private free enterprise — with reasonable umpiring by government to insure fair play — representative democracy, and civil and religious liberty are the three inseparable supports of personal freedom. They must stand or fall together. Our forefathers came to these shores imbued with a sense of deep personal responsibility not only toward moral questions but toward their own material success. Under the impact of the current approach to the problem of government, "What can I get out of it, whether I am entitled to it or not?" we have drifted far from our ancient moorings. Today every technically trained man in the Republic has a peculiarly grave responsibility: to contribute, liberally and unselfishly, through clear scientific thinking as opposed to crowd emotions, to an intelligent solution of our pressing national problems.

Education that does not mold the moral sense of a human being as well as his reasoning powers is lethal poison to the individual and social dynamite to the body politic. Every once in a while, I am told, an electron jumps out of its regular path in an incandescent lamp. The equation expressing the possibility that any specific electron will so do, is in direct accord, I understand, with the mathematical laws of probability. Hence a great modern scientist has concluded that so-called natural laws are merely "summations of statistical averages." If in connection with the R of rectitude the technically trained man, in his human relationships, should now and then jump the track like a vagrant electron, he, like all the rest of us poor human beings, may find consolation in the fact that our vagaries of conduct merely reflect a "summation of statistical averages," which we must keep at as high a level as Divine aid and personal intelligence will permit.

POOR & COMPANY

RAILWAY EQUIPMENT

CHICAGO, ILLINOIS



In co-operation with Arthur G. McKee & Company, the Falcon Bronze Company supplied the copper for this latest 1000 ton Blast Furnace of Great Lakes Steel Corporation.

Courtesy of Great Lakes Steel Corporation

COPPER and BRONZE CASTINGS

By an Organization Specializing Since 1890 in Non-Ferrous Castings for Blast Furnaces, Steel Mills and Heavy Industry

SPECIALISTS, acquainted with steel mill operation, and the exacting requirements of modern equipment, working constantly on new alloys and new methods to produce parts of greater uniformity, more strength, finer quality and better value. Falcon has been able to specialize in commercial applications of newly discovered alloys and in castings that are difficult for the ordinary non-ferrous foundry to cast.

● ●

Falcon "Anchorless" Bosh Plates, Haven Double Compartment Cooling Plates.

Monkeys, Valves, Valve Seats, Coolers and Castings for Blast Furnaces, Standard Tuyeres, Steinbacher Angle Flow Tuyeres, Falcon Shrouded Tuyeres, Beaton Refractory Nose Tuyeres, Butler-Henry Heavy Nose Tuyeres and Beaton-Ledbetter Tuyeres.

Housing Nuts, Screw Boxes, Thrust Bearings, Heavy Gears, Structural Parts and Bearing Bronzes for Sheet, Tin and all types of Rolling Mills. Copper Welding Bells, (licensed by National Tube Company, Subsidiary of United States Steel Corporation).

High Electrical Conductivity Copper Castings for Electric Welding. High Quality Bearing Bronzes and Non-Ferrous Castings for Steel Mills and Railroads. Acid-Resisting Metal.

Jas. L. Wick, Jr., *Pres. and Gen. Mgr.* M.I.T. '06 — Course II

FIFTIETH ANNIVERSARY

FALCON BRONZE CO.

Organized 1890

Incorporated 1895

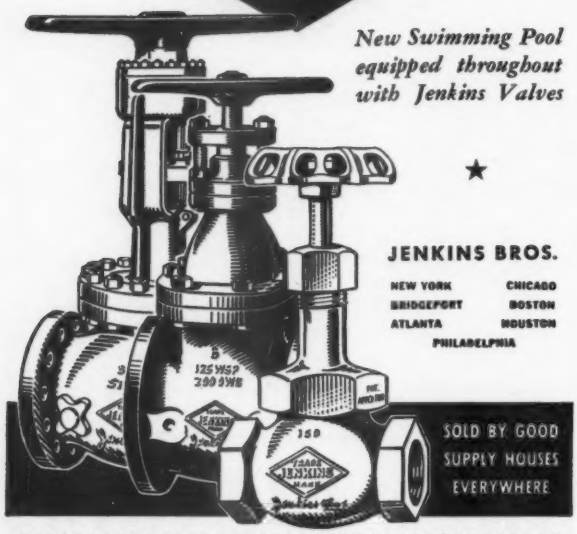
YOUNGSTOWN, OHIO

Jenkins
BRONZE IRON STEEL
VALVES

New Swimming Pool equipped throughout with Jenkins Valves

★

JENKINS BROS.
NEW YORK CHICAGO
BRIDGEPORT BOSTON
ATLANTA HOUSTON
PHILADELPHIA



SOLD BY GOOD SUPPLY HOUSES EVERYWHERE

Plumbing Contractors and Engineers

M.I.T.
SWIMMING POOL
BUILDING
AND
FILTRATION PLANT

•

WILLIAM H. MITCHELL & SONS CO.
90 Arch Street, Boston, Mass.

Stanwood E. Whitcombe '23, President

NEWS AND THE STATE

(*Continued from page 373*)

what his personal presence in Paris in advance of the tragic news would do was based on his complete understanding of mass psychology. He knew that his presence would be an antidote to the despair occasioned by a realization of disaster. No matter how tragic, when the populace finally received the news it would be that of a disaster long past, of which only the general outlines would be known.

Contrast that with present conditions. Today millions of people throughout the world are receiving daily, hourly, and almost by the minute, complete news not only of disasters but actually of disasters in the making. Very frequently we receive news piecemeal as the disaster develops — a sort of preview as it were. This is particularly true here in America. Under these conditions it seems to me inevitable that our reactions to events which affect us and our future well-being cannot possibly be the same as they would be if we were to be informed at a much later date.

Not only is the magnitude of our intake of news and information vastly greater than that of any previous time but, in addition, matters of real importance are so inextricably mixed up with a mass of essential triviality that it is frequently difficult, if not impossible, to disentangle the two. The mere magnitude of the facilities for collection, transmission, and dissemination of intelligence, and the desire fully to employ these facilities make this difficulty inevitable.

In this maze, it is frequently the trivial rather than the important which dominates our emotions and hence our reactions and actions. When I speak of trivial or inconsequential, I mean things which are trivial or inconsequential as related to the main course of events. Each such item in itself may justify a strong emotional reaction but be of no importance whatever when it comes to determining how we should *act*. In a war like the present one in Europe, the loss of a battleship or the bombing of a city or the loss even of an army is in itself a tragedy, but it may be, and probably is, an insignificant triviality in determining the ultimate outcome of the conflict. Mass action based merely on the emotions thus developed is more likely than not to be wrong. Back in the time of the Napoleonic wars to which I have alluded, and in all recorded time before the advent of modern facilities, most of the trivial and inconsequential trappings of events were (*Concluded on page 400*)

YALE LOCKS *and* HARDWARE

M.I.T. POOL BUILDING by

J. B. HUNTER COMPANY
60 Summer Street Boston, Massachusetts

ABERTHAW COMPANY

BOSTON, MASSACHUSETTS

❖

Construction Managers for

NEW SWIMMING POOL BUILDING

Massachusetts Institute of Technology

Toughest..

most abrasion resistant rubber compound known for covering wires and cables is . .

Simplex-TIREX

Selenium Rubber Armor

SIMPLEX WIRE & CABLE Co

79 Sidney St., Cambridge, Mass.

NEWS AND THE STATE

(*Concluded from page 398*)

extracted from the news before that news reached the ultimate consumer. Thus it was only major results of past events which reached men and women and impelled them to future action.

Before the advent of these modern methods of communication, people were not, it seems to me, so likely to be moved by their emotions as they now are. They were more likely to be moved by their reason, simply because they were compelled to deal with the prospective effects of past events. Now, immersed as we are in this vast flood of information, trivial and important, I for one find myself continually confronted with a tendency to be actuated by my emotions rather than by my reason.

There is no cause to anticipate any return to a more leisurely method of news transmission. Quite the contrary. Our problem for the future is one concerned with operation of a world actuated largely on an emotional, rather than on a reasoning, basis. In the circumstances it seems to me that the very facility and adequacy of our reporting of events impose upon us an added burden of trying to avoid being driven into mass action solely on the basis of a succession of emotional eruptions.

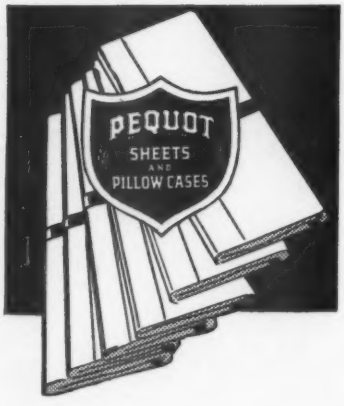
This, it seems to me, is possibly the greatest of the social problems which science, applied to the art of communication, has posed for mankind.

WORLD NEWS GATHERING

(*Continued from page 375*)

cation were immediately disrupted. Cities which before the war were unimportant as communication centers suddenly became transcendently vital. Warsaw, for example, immediately became important and remained so until the Polish government collapsed under the impact of German and Russian drives. Bucharest, Budapest, Stockholm, and Copenhagen also loomed as transmission centers as the war area spread.

In fact, so rapidly did the transmission centers change during the early stages of the war that we could never be sure from what point we would hear from our own men. George Kidd of our Berlin staff, who had been assigned to cover the Danzig front late last August, had to leave there suddenly. Within twenty-four hours thereafter, we began to receive his dispatches from Riga,



PEQUOT MILLS

SALEM, MASS.

HENRY P. BENSON — *Class '86*
President

Telephone Hancock 7278

GALASSI COMPANY

Roman and Venetian Mosaics, Terrazzo, Marble, Slate, Floor and Wall Tiles, Ceramic Mosaic

BENNET *and* ASH STREETS
BOSTON, MASS.

by way of Moscow for cables and by way of Copenhagen for telephone and radio. Ferdinand Jahn's filing from Bucharest, which city early in the war proved so valuable as a relay center after the fall of Warsaw, began to reach New York by radio, relayed from Rome.

Norman Deuel, our Moscow manager for several years, had been in Helsingfors, waiting for eventualities, for quite a few weeks before the war started in Finland. When the Germans suddenly invaded Norway and took Narvik, Peter Rhodes of the United Press staff was not there by accident. He had been waiting there for several days before the invasion started. These examples reveal that possession of the properly trained manpower is not enough to assure proper coverage. It is necessary also to have the right man at the right point at the right time. Yet even that is not sufficient unless facilities are available for telling the world the story.

When the Russian attack on Finland began last winter, Norman Deuel was awakened by the first bomb dropped on the Helsingfors airport. He telegraphed the first flash on the news and, leaving his wife to duplicate the flash by telephone to Copenhagen, rushed out to get details. Just as he returned to his hotel, he was knocked down by a bomb which destroyed a near-by building. Lying on the floor long enough to let the splinters settle, he arose to put in an urgent telephone call to Copenhagen. While he stood waiting for the call to come through, the dome of the hotel lobby collapsed in a crash of glass. But Deuel got his call through and completed it, although that entire section of Helsingfors was a rubble of broken glass and ruined buildings, with the dead lying in the streets.

As part of our plan to establish proper communications, we also prepared several years ago a transmission center in Amsterdam which was able to communicate efficiently and rapidly with North and South America. We maintained a very large bureau there, staffed by United Press men of various nationalities — British, French, German, Dutch, and American. As soon as Germany invaded Holland on May 10, the Amsterdam personnel situation became difficult. Three British United Press men had to be evacuated to London two days later. They arrived safely after a perilous journey, during which convoyed busses en route to a channel port were constantly strafed by German bombers.

I think it must be evident to anyone reading the dispatches that the coverage of this war, so far as comprehensiveness and volume are (*Concluded on page 402*)

— STEEL —
HOT AND COLD ROLLED
DEFORMED BARS FOR CONCRETE
NORWAY IRON BARS
Stahleker Steel Corp.
Second and Binney Sts., Kendall Sq., Cambridge, Mass.
Telephone Trowbridge 1440
WALLACE BLANCHARD, '16, *Treasurer*

PRINTING
LETTERPRESS AND OFFSET
Of outstanding quality is produced by us daily for many buyers of good printing. Our forty years experience and modern equipment are available to you in caring for your printing problems
THE MURRAY PRINTING COMPANY
KENDALL SQUARE, CAMBRIDGE

Suntile
Bright with color-Right for life
E. STANLEY WIRES CO., INC.
Designers and Tile Contractors
TILE INSTALLATIONS HAVE BEEN COMPLETED FOR
VASSAR COLLEGE POOL
WHEATON COLLEGE POOL
M. I. T. SWIMMING POOL
M. I. T. FIELD HOUSE
WELLESLEY COLLEGE POOL
WILLISTON ACADEMY POOL
120 BOYLSTON STREET
BOSTON, MASSACHUSETTS
E. STANLEY WIRES '07
PAUL L. CUMINGS '07

NORTHEASTERN UNIVERSITY
SCHOOL of LAW

DAY PROGRAM—Three Years
EVENING PROGRAM—Four Years

• • •

A minimum of two years of college work required for admission.
A limited number of scholarships available to college graduates.

LL.B. Degree conferred
Admits men and women

47 MT. VERNON ST., BOSTON
Near State House

BIG IN VALUE . . .
LITTLE IN COST

Few things give you so much convenience, happiness and security as your telephone. Even so, its cost is little. Nowhere else in the world do people get so much telephone service, and such good and courteous service, at such low cost.

BELL TELEPHONE SYSTEM

THE
RUMFORD PRESS
CONCORD
NEW HAMPSHIRE

WHERE PRINTING IS
STILL A CRAFT

WORLD NEWS GATHERING

(*Concluded from page 401*)

concerned, is much better than that of the World War. There are no more cables now than during the conflict of 1914–1918, but technical advances have greatly expanded the potential volume of each cable. In addition, the use of radio has developed far beyond anything even conceived during the former war. These developments have made possible the acceleration of news transmission in all classifications of service. In my opinion newspaper correspondents themselves have also considerably improved their technique and have been able to put into effective use the lessons learned during the great war of twenty-five years ago. During that war if a news agency received by cable and radio 2,000 to 3,000 condensed words a day from Europe, that was a pretty large filing. I think it is no exaggeration to say that during the present war the volume received from Europe must be eight or ten times that. Although advances in cable and radio technique have brought about very substantial decreases in the cost per word of press tolls, the cost of covering the present war is several times as great as was that of its predecessor. One reason is the vastly expanded interest in war news.

Comparison of the content of the average newspaper in this country with that of any newspaper in any totalitarian country in Europe shows a startling difference. It will be noted at once that the American newspaper publishes statements on all sides of all questions. The totalitarian newspaper publishes only what the government wants it to print. The American newspaper will publish what the reader wants to read. The totalitarian newspaper will publish only what the government wants the reader to read.

Let no man make any mistake about the sanctity of that provision of our Bill of Rights which refers to freedom of the press, freedom of speech, freedom of worship, and freedom of assembly. Let no man delude himself into the belief that some slight violation of freedom of the press or of speech might be tolerable. There is no such thing as a *slight* violation of freedom of the press or of speech or of religion. Any violation is at least potentially mortal. All that needs to be remembered is that once upon a time there was freedom of the press, of speech, of religion, in the continental countries which are now totalitarian.

RADIO IN WORLD AFFAIRS

(*Continued from page 377*)

free press. The report of an address by Hitler in the daily press would hardly arouse suspicions that this or that newspaper was pro-German. Neither would the publication of the text of Winston Churchill fix the idea in the reader's mind that a journal was unalterably aligned with the interests of the British Empire. Yet no sooner will Hitler have uttered his last word over our networks than protests will flood the switchboard at Radio City. The National Broadcasting Company, we are certain to hear, is either knowingly or stupidly lending American radio facilities to the spread of insidious foreign propaganda. Similar protests, though usually in smaller volume, will arrive shortly after the broadcast of a British or French political leader. We are called "fascist" whenever the N.B.C. networks carry the voices of Hitler or Mussolini. We know that the label of "communist" or "socialist" will be freely applied whenever our microphones have been placed at the disposal of Earl Browder or Norman Thomas, whether these men speak on domestic or foreign issues. We are "capitalist" and "laborite," and "radical," "conservative," and "liberal" by turn. And to different persons we may even appear to be "patriotic" and "subversive" at one and the same time.

This is as it should be. Whatever the reason for the protests — whether it be that the American listener is more vociferous than the foreign or that, with three competing networks clamoring for his attention, he feels perfectly free to criticize — we welcome them. The variety of epithet indicates that we are near to the ideal of a fair balance.

Now, speeches on world affairs of wide public interest are almost invariably expressions of opinion. They are usually propaganda, if you will, for the adoption of the speaker's special point of view. It follows, therefore, that much of broadcasting's service to the listener, with respect to both domestic and foreign affairs, is tied up with freedom of the air. This matter has been widely, though not always intelligently, discussed. Too often it is assumed that the rules governing free speech or a free press apply, without change, to radiobroadcasting. They do not. Theoretically everyone may exercise the right of free speech simultaneously. There would, of course, be no audience for any of the speakers, but the right would be exercised all the same. Further, there would seem to be no great obstacle to the publication, by any interested person, of a newspaper or pamphlet and its subsequent distribution by hand or mail.

But the number of radio stations is limited by the number of channels for domestic broadcasting at the disposal of our government. Also, since the broadcasting day generally extends to not more than eighteen hours, time is limited. Within these bounds broadcasting must try to satisfy all demands for time on the air for the discussion of controversial public issues. The question of American aid to belligerents is a single instance. The issue of international trade agreements is another. In presenting broadcasts of opinion on such subjects, the National Broadcasting Company applies the rule of equal opportunity. Stated differently, N.B.C. tries to present speakers of as nearly equal prominence as possible at equally favorable periods of the day over stations covering the same areas. We are never completely successful in applying the rule, but we always aim at the ideal of mathematical equality. (*Concluded on page 404*)

PREPARATORY SCHOOLS FOR BOYS

CHAUNCY HALL SCHOOL

Founded 1828. The School that confines itself exclusively to the preparation of students for the Massachusetts Institute of Technology.

FRANKLIN T. KURT, *Principal* 553 Boylston Street, *Boston, Mass.*

CRANBROOK SCHOOL

Distinctive endowed preparatory school for boys. Also junior department. Exceptionally beautiful, complete, modern. Unusual opportunities in music, arts, crafts, sciences. Hobbies encouraged. Broad program of sports. Single rooms. Strong faculty. Individual attention. Graduates in over 50 colleges. Near Detroit. Overnight from New York.

REGISTRAR
5360 Lone Pine Road, Bloomfield Hills, Michigan

HEBRON ACADEMY

Thorough college preparation for boys at moderate cost. 81 Hebron boys freshmen in college this year. Excellent winter sports facilities. Ski trails, ski camps. Covered skating rink. Experienced winter sports coach.

For catalogue and illustrated booklet address

RALPH L. HUNT, *Principal* Box T, Hebron, Maine

HUNTINGTON SCHOOL FOR BOYS

Five Forms. Special two-year course for entrance to M.I.T.

Summer Session (Co-educational) Send for catalogues

CHARLES H. SAMPSON, Ed.M., Headmaster

320 Huntington Ave., Boston *Tel. Kenmore 1800*

OXFORD ACADEMY

Assures preparation for M.I.T. and other colleges if student accepted by us, irrespective of previous difficulties. Socratic-psychological method, 30 years without a failure. Each student in a class by himself. Taught concentration, how to study. Limited to 15 boys. Enroll any time.

Catalog. DIRECTOR, Box M-95, Pleasantville, N. J.

FOR LISTING IN THIS SECTION

Apply to

BUSINESS MANAGER

THE TECHNOLOGY REVIEW

Transits and Levels are used on all largest works and by U. S. Govt. for utmost precision. Rental Insts.

New catalog, just issued, sent gratis

BUFF & BUFF CO. Boston 30, Mass.

L. F. Buff '97 — Henry A. Buff '05

A souvenir plumb-bob sent for 3c postage

William H. Coburn, '11 William F. Dean, '17

William H. Coburn & Co.

INVESTMENT COUNSEL

68 Devonshire St. Boston, Mass.

MONSANTO CHEMICAL COMPANY

Merrimac Division

EVERETT
MASSACHUSETTS

The largest and oldest chemical manufacturer in New England

FIDELITY DRUM SPOOLING MACHINE

For efficient multiple-spool winding with uniformly smooth lay. Wooden or paper spools. Winds from barrel or pin swifts, cops, cones, etc. Write for catalog.

OTHER FIDELITY MACHINES
Braiders
Backwinders
Circular Knitting Machines
Cylinders and Dials
3-Color Yarn Selector & Knot Tyer
Fringe & Tassel Machines
Giant Package Winders
Raschel Machines
Ribbers
Wire Covering Machines
Belt Loop Cutters
Pocket Folding Machines
Special Machines designed and built

FIDELITY MACHINE CO.
3908-18 Frankford Ave., Philadelphia, Pa.

RADIO IN WORLD AFFAIRS

(*Concluded from page 403*)

So long as broadcasting lends itself to the expression of opinion, we can no more avoid spreading propaganda than can the newspaper which carries an account of a speaker's message. The danger is not in spreading propaganda but in the elimination from the air waves of all propaganda except one particular variety. Free discussion is democracy's way of settling an issue.

I pointed out earlier that under the American system of broadcasting, radio is a private enterprise. It may be wondered why any network company should make an intense effort to cover world affairs for its listening audience when such a service produces no revenue and is, in addition, highly expensive. The answer is to be found in the fact that American radiobroadcasting is fiercely competitive. Whatever success comes to the broadcaster must be measured in terms of his listening audience. To hold the interest of that audience, the broadcaster must provide a free program service equal to, and preferably better than, the competing services. His constant fear is the slight movement of the knob that tunes out his program and brings in one of those offered by his rivals. This will explain why year after year the number of programs traveling westward over the Atlantic far exceed those eastbound for rebroadcast in Europe and why American radiomen are so hungry for scoops.

In the past, critics of the American system of broadcasting have singled out its commercial nature as a glaring weakness. Government radio, it was confidently asserted, could devote itself entirely to the work of public education and the spread of culture, whereas private radio is forced by necessity to devote large portions of the broadcasting day to making a living. The turn of events has brought some surprising changes in attitude. Without fear of contradiction it may be said that in every country where government has exercised a control over radio, there also the hand of the censor has been felt in the selection and presentation of news and opinion. To the extent that this control has been exercised, radio has ceased to be a faithful mirror of world affairs or an adequate instrument for the expression of public opinion.

Surely the cost of listening to a few commercial announcements, even though they recommend the purchase of a particular kind of cigarette or tooth paste, is a small price to pay for a free system of radiobroadcasting. American radio has achieved independence by taking its own risks as a business organization. Its success as an advertising medium has given it the means for establishing a widespread system for gathering and circulating news and opinion, for breaking new ground in mass education, and for promoting the ideals of religion and of the liberal democratic way of life. It is not perfect, but it is far from becoming the complaisant servant of any single group. So long as the success of radio depends on the number of listeners whose interest can be held, the broadcaster will strain every nerve to serve the public to the best of his ability and the limits of his purse.

And let us not forget that wherever radio has lost its freedom, there also have disappeared the parallel freedoms of the press and of education and often of religion.

PROFESSIONAL CARDS

JACKSON & MORELAND
Engineers

Public Utilities — Industrials
Railroad Electrification
Design and Supervision — Valuations
Economic and Operating Reports

BOSTON NEW YORK

H. K. BARROWS, '95
M. Am. Soc. C. E.

CONSULTING HYDRAULIC ENGINEER

Hydro-electric developments — Water supplies. Reports, plans, supervision. Advice, appraisals.

6 BEACON STREET BOSTON, MASS.

EADIE, FREUND AND CAMPBELL
CONSULTING ENGINEERS

110 WEST FORTIETH STREET NEW YORK CITY

Plans and Specifications — Examinations and Reports

Power, Heating, Ventilating, Electric, Plumbing, Sprinkler, Refrigerating, Elevator Installations, etc., in Buildings and Industrial Plants

J. K. CAMPBELL, M. I. T. '11

DAY & ZIMMERMANN, INC.
Engineers

W. FINDLAY DOWNS '15, *Pres.*

Design — Construction — Management
Investigations and Reports
Public Utilities and Industrials

New York Philadelphia PACKARD BLDG. Chicago

F. L. LAZO, *C. Eng.* '21
M. L. DEHESA G. FARÍAS, *Architect*
J. MARTÍNEZ T., *Mech. Eng.*
(Cornell '25)

Engineers and Architects

PLANS AND SPECIFICATIONS — EXAMINATIONS AND REPORTS

Construction Consultants—Power, Public Utilities, Heating, Architect and Arch. Engrs. Ventilating-Refrigerating-Ind. Plants—Estimates and Valuations

AV. MADERO NO. 1 MEXICO, D.F., MEXICO

FAY, SPOFFORD & THORNDIKE
ENGINEERS BOSTON, MASS.

BRIDGES WATER SUPPLY AND SEWERAGE
PORT AND TERMINAL WORKS
FIRE PREVENTION
INVESTIGATIONS DESIGNS
SUPERVISION OF CONSTRUCTION

STANLEY G. H. FITCH '00
CERTIFIED PUBLIC ACCOUNTANT

of PATTERSON, TEELE & DENNIS
1 Federal Street, Boston, Mass.

Cost Accountants and Auditors — Tax Consultants

NEW YORK BOSTON WASHINGTON

REPRESENTATIVES IN OTHER PRINCIPAL CITIES OF THE UNITED STATES, CANADA, ENGLAND AND AUSTRALIA

MAURICE A. REIDY
Consulting Engineer

BRIDGES BUILDINGS
STRUCTURAL DESIGNS FOUNDATIONS
CONSTRUCTION CONSULTANT AND ARCHITECTURAL ENGINEER

Estimates and Appraisals

44 SCHOOL STREET BOSTON, MASS.

EVERETT E. KENT

Registered Attorneys in
Patent, Trade Mark and Copyright Causes
United States and Foreign

75 Federal Street, Boston HUBbard 0234

MORAN, PROCTOR, FREEMAN & MUESER
CONSULTING ENGINEERS

420 LEXINGTON AVENUE NEW YORK CITY

Foundations for Buildings, Bridges and Dams;
Tunnels, Bulkheads, Marine Structures;
Soil Studies and Tests;
Reports, Design and Supervision.

WILLIAM H. MUESER, '22

AN AID TO INDUSTRY IN LOCATING OUTSTANDING MEN

PLACEMENT STATUS
of
1940 GRADUATES

(as of June 6, 1940)

The results of a recent employment survey of the Class of 1940 are shown in the table below:

EMPLOYMENT STATUS	*Recipients Doctor's Degree*		*Recipients Master's Degree*		*Recipients Bachelor's Degree*		*All Groups*	
1940 GRADUATES as of June 6, 1940	No.	%	No.	%	No.	%	No.	%
Have Accepted Employment	29	70.7	182	88.8	318	70.8	529	76.1
Unclassified	12	29.3	23	11.2	131	29.2	166	23.9
TOTALS	41	100	205	100	449	100	695	100

PLACEMENT BUREAU

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

CAMBRIDGE, MASS.

AN AID TO ALUMNI IN FINDING DESIRABLE POSITIONS

Investigate

The New

KINGSBURY FLEXIMATIC

A Multidirectional Chucking Machine

For 1940

Put your high production

DRILLING
TAPPING
COUNTERBORING
REAMING
FACING
SAWING
and
LIGHT MILLING

on these cost-cutters

AUTOMATIC DRILLING *by the* KINGSBURY METHOD

These modern index type machines will enable you to step up your production and at the same time insure the highest accuracy on your work.

Explore the possibilities offered by Kingsbury Automatic Indexing Machines on your production line. Machines with the following table sizes are available: 12", 20", 28", 36", 50". Write for detailed specifications.

Kingsbury Machine Tool Corp. **KEENE NEW HAMPSHIRE**

EDWARD J. KINGSBURY, 1915, *President and Treasurer*

ORIGINATORS OF THE AUTOMATIC DRILL HEAD UNIT

NEW SQUARE-WAVE GENERATOR

for Audio Frequency Testing

GENERAL RADIO announces the new Type 769-A Square-Wave Generator, primarily designed for audio-frequency testing. In its essentials the circuit consists of an amplifier arranged to overload with great ease. A voltage of from 2 to 8 volts, obtained from the power line or an external source, is amplified to about 75 volts and then has both sides of the wave cut off by a double diode. This squared signal is re-amplified and clipped again by a pair of cascaded diodes. The signal is then amplified and attenuated to any desired level.

It is now generally recognized that the entire behavior of an amplifier or other circuit to applied signals is completely determined by a knowledge of its response to sinusoidal signals in phase and amplitude over the frequency scale. Similarly its performance is completely determined from its transient response to an abrupt steep wave front — a square wave.

The square-wave generator method of testing audio systems offers the simplest and most direct method for observing the effects of both phase shift and amplitude response in a single test. Square-wave generators are very valuable in a-f testing of the over-all response of television systems, amplitude or frequency-modulated systems, receivers, amplifiers or any of the audio-frequency components of any of these.

Type 769-A Square-Wave Generator • $225.00

● *WRITE FOR BULLETIN 592*

SPECIFICATIONS

Frequency Range

Square waves with fundamentals from 10 cycles to 5000 cycles per second can be produced. The output circuit passes frequencies between 0.1 cycle and 250,000 cycles.

Output Voltage

Continuously variable — peak-to-peak, 150 volts with balanced output; 75 volts, unbalanced. Minimum output voltage 10 microvolts.

Attenuator

Step-wise and 6-step multiplier are used. The wave shape is not affected by the attenuator.

Squareness of Waveform

At low frequencies, entire rise in voltage takes place in 0.001 cycle.

Output Impedance

500 ohms, balanced; 250 ohms unbalanced. The impedance is independent of frequency down to d-c.

External Oscillator

An oscillator capable of delivering 6 volts, open circuit, is required to excite the generator. A 60-cycle control system is built in.

GENERAL RADIO COMPANY

CAMBRIDGE, MASSACHUSETTS

Branches in New York and Los Angeles

R

ng

Y